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U. S. DEPARTMENT OF AGRICULTURE

ABSTRACTS

of recent published material on Soil and Water Conservation

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SOIL SCIENCE (Basic)

Soil Physics

Adams, J. E., and Matelski, R. P. DISTRIBUTION OF HEAVY MINERALS AND SOIL DEVELOPMENT IN SCOTT SILT LOAM. Soil Sci. 79: 59-69. 1955

An investigation was made of the distribution of heavy minerals in the very fine sand (0.1 to 0.05 mm.) and coarse silt (0.05 to 0.02 mm.) separates of Scott silt loam. The heavy minerals were separated quantitatively in s-tetrabromethane of specific gravity 2.96 by centrifuging. The mineral species of the total heavy mineral fraction were identified by use of the petrographic microscope for observing the diagnostic properties and characteristics of the different minerals.

A quantitative value for distribution of the mineral species in the different depths was obtained by random counting of a minimum of 500 mineral grains in each separate at each depth. Thirteen heavy minerals occurred in sufficient quantity for identification. These were green and brown hornblende, tremolite, basaltic hornblende, biotite, muscovite, ilmenite, magnetite, leucoxene, tourmaline, zircon, garnet, and rutile.

Aronovici, V. S. MODEL STUDY OF RING INFILTROMETER PERFORMANCE UNDER LOW INITIAL SOIL MOISTURE Soil Sci. Soc. Amer. Proc. 19: 1-6. 1955.

A glass-faced tank provides an excellent opportunity to observe the nature and rate of advance of the wetting front from a ring infiltrometer under varying conditions of profile, soil moisture, and ring size. A comparison of the hydraulic conductivity of the soil material contained within the ring infiltrometer with the observed infiltration velocity illustrates the significance of the hydraulic gradient upon the observed rate. The study further indicates the relative importance of ring size, ring depth, and profile upon infiltration velocities.

Oxidation-reduction potentials were measured in situ with bright platinum electrodes to determine the relationship between these potentials, and the dissolved oxygen present. The potentials measured were not found to be a reliable index of the dissolved oxygen present.

Dreibelbis, F. R. SOIL TYPE AND LAND USE EFFECTS ON PERCOLATION OF SOIL WATER THROUGH MONOLITH LYSIMETERS. Soil Sci. Soc. Amer. Proc. 18: 358-362. 1954.

This paper presents a summary of data on percolation of soil water through monolith lysimeters with an 8-foot profile covering 1938. The effects of soil type and land use on percolation are stressed. Soil type influences amounts and rates of percolation. The Muskingum soils, because of their lighter texture, provide greater opportunity for more rapid soil water movement which is reflected in greater amounts and more rapid rates of percolation than heavier Keene soils except under the circumstances noted. When all the lysimeters were in grass, the average annual percolation amounted to 16.0 inches on Muskingum silt loam (sandstone); 9.85 inches on Muskingum silt loam (shale); and 8.26 inches on the Keene silt loam. From 83 to 92 percent of the total annual percolation is obtained during the first 6 months of the year.

Soil conservation practices involving greater crop production have resulted in an appreciable decrease in percolation. This is due largely to the better vegetative cover and growth which removes more water by transpiration, thereby leaving a lesser amount of soil water available for percolation.

Fukuda, H. AIR AND VAPOR MOVEMENT IN SOIL DUE TO WIND GUSTINESS. Soil Sci. 79: 249-256. 1955.

The purpose of this article is to emphasize the effect of wind gustiness on the transmission of air pressure into the soil and on the volume of air transported through the soil surface. The depth of penetration and the amount of vapor taken from the surface are also discussed. A theoretical formula, which measures pressure transmission and air movement is derived from Darcy's law and tested by experimental data. The soil depth to which air can penetrate as a result of wind gustiness is very slight. Even in sandy soil, the particles of which have a mean diameter of 0.5-0.25 mm., it penetrates only about 5 mm. below the surface.

The volume of air transported from sandy soil into the atmosphere by wind gustiness in a day is estimated to be equivalent to that occupied by a column 1 to 20 meters high, depending on the period of atmospheric pressure fluctuation on the soil surface, but the amount of vapor transported by this air movement is very small.

Gardner, R. RELATION OF TEMPERATURE TO MOISTURE TENSION OF SOIL. Soil Sci. 79: 257-265. 1955.

A study was made to determine the effect of temperature on soil-moisture tension of three soils at constant moisture percentages. Data are presented which show a consistent tendency for tension to decrease at approximately 0.008 atmosphere per degree rise in temperature within the range of 0 to 50°C. The possibility of temperature-induced moisture percentage gradients in the soil at the time the tensiometers were read raises a question regarding the part of the tension variation that can be attributed to the direct effect of temperature on soil-moisture tension and the part that should be attributed to the indirect effect through temperature-induced moisture percentage gradients.

Regardless of this question, however, the data show that variations due to temperature may be so great that they cannot well be ignored in studies of soil-plant relationship or soil-moisture movement.

Harding, R. B. SURFACE ACCUMULATIONS OF NITRATES AND OTHER SOLUBLE SALTS IN CALIFORNIA ORANGE ORCHARDS. Soil Sci. Soc. Amer. Proc. 18: 369-372. 1954.

Information presented shows that in furrow-irrigated California orange orchards, as much as 3 tons of soluble salts per acre, representing 800 lbs. of nitrogen as well as other necessary plant nutrients, may accumulate in the upper 6 inches of the interfurrow ridges as a result of capillary conduction. These accumulations have little chance of being of benefit to the trees under present cultural practices. Factors controlling the rate of surface concentration of salts are rate of evaporation, amount of irrigation, kind and amount of soluble salts available as source material, type and shape of furrow, and soil texture and profile characteristics. Surface salt concentrations have been shown to be greater in orchards that are not tilled than in those that are tilled.

Soil Chemistry

Aldrich, D. G., and Buchanan, J. R. LABORATORY STUDIES OF REACTIONS BETWEEN INJECTED LIQUID NITROGEN DIOXIDE AND VARIOUS SOILS, WITH SPECIAL REFERENCE TO ITS POSSIBLE USE AS A FERTILIZER. Soil Sci. Soc. Amer. Proc. 19: 42-47. 1955.

The experiments described in this report were conducted to determine: (1) the reactions that occur when liquid nitrogen dioxide is injected into various types of soil, (2) the magnitude of gaseous losses of nitrogen dioxide or its decomposition products from the soil, and (3) the possible accumulation of toxic decomposition products of oxides of nitrogen in the soil.

The results of these studies lead to the following conclusions: (a) Injected liquid nitrogen dioxide is readily adsorbed by soil. Losses as gaseous nitrogen dioxide or nitric oxide are less than 1 percent. (b) In acid, neutral, or unbuffered alkaline soils, injected liquid nitrogen dioxide produces a sufficiently acid soil reaction to insure rapid and complete chemical oxidation to nitric acid. (c) In highly buffered alkaline calcareous soil the injected liquid nitrogen dioxide produces little change in soil reaction and is only partially oxidized to nitric acid. Approximately one third of the nitrogen injected exists temporarily as nitrous acid.

Chang, C. W., and Dregne, H. E. EFFECT OF EXCHANGEABLE SODIUM ON SOIL PROPERTIES AND ON GROWTH AND CATION CONTENT OF ALFALFA AND COTTON. Soil Sci. Soc. Amer. Proc. 19: 29-35. 1955.

Identical portions of productive Gila clay loam, an important irrigated soil in the Southwest, were treated with Na_2Co_3 to obtain increasing levels of exchangeable sodium. After being incubated to equilibrium at field (moisture) capacity the soils were dried, ground, and sieved for laboratory tests and greenhouse experiments.

The treated soils showed increases in exchangeable sodium percentage, soluble Na, soluble carbonate and pH, and a decrease in soluble Ca. Approximately 75 percent of the added Na_2Co_3 was adsorbed as exchangeable sodium. The dispersion ratio and moisture retention of the soil increased with the increase in exchangeable sodium percentage.

Alfalfa and cotton were grown under greenhouse conditions, and the plant tissues were analyzed. Reduction in yield of alfalfa and cotton was first noticeable at about the 35 percent level of sodium saturation. Treating the soil with a synthetic soil conditioner increased growth of the alfalfa at sodium levels that were detrimental on the unconditioned soils. The synthetic soil conditioner had no appreciable effect on cotton growth. This finding indicates that exchangeable sodium probably has a direct, as well as an indirect, adverse influence on crop growth.

Cooper, H. P., and Hall, E. E. DIFFERENTIAL IN POTENTIAL PRODUCTION AND IN UTILIZATION OF NITROGEN AND POTASSIUM BY CALCIUM-ACCUMULATING AND SILICON-ACCUMULATING CROP PLANTS. Soil Sci. 79: 441-458. 1955.

Application of the balanced-baulic-poundage ratio of nutrients to available plant chemical analyses data from major crops offers a mathematical quantitative expression to some of the mineral nutrition problems in plants. This mathematical approach gives quantitative confirmation of the conclusions resulting from more or less empirical investigation. Comparing the obtained ratio of nutrients in plants with the balanced-baulic-poundage nutrient ratio provides a means of determining the sufficiency of the major fertilizer nutrients for the nutritional complex under consideration.

Arranging chemical composition data in order of relative strength of nutrient ions as expressed in standard electrode potential may bring into bold relief certain specialized biochemical mechanisms or specialized metabolisms characteristic of certain crop plants. If the quantity of a specific nutrient, where comparable concentrations are considered, in the plants deviates significantly from the relative order in the strength of elemental ions, the presence of selective accumulating or selective excluding specialized metabolisms in the plants is indicated.

deKock, P. C. IRON NUTRITION OF PLANTS AT HIGH pH. Soil Sci. 79: 167-175. 1955.

Mustard plants were grown in nutrient solution at pH 7.8 with iron (1 ppm) supplied as the chloride, Versenate, Versenol, and Versene-diol. Sodium chloride or sodium bicarbonate was added to each treatment, and each set of eight was aerated with 1 or 20 percent oxygen (air). Iron nutrition of the plants showed a progressive improvement in the four forms of iron in the nutrient in the order mentioned. Bicarbonate tended to increase the severity of chlorosis, whereas reduction of oxygen supplied to the roots reduced chlorosis. Analyses of these plants are given, and the various effects are discussed with special reference to the phosphorus-iron ratio as an index of the iron status of plants.

Graham, E. R. AVAILABILITY OF NATURAL PHOSPHATES ACCORDING TO ENERGY CHANGES. Soil Sci. Soc. Amer. Proc. 19: 26-29. 1955.

A study of the availability of natural phosphates to oats showed that the amount of phosphorus harvested by the plants was related to the relative driving energies of the different colloidal systems mixed with the rock phosphate.

Amberlite, mixed with rock phosphate, was the most effective system for increasing the availability of the phosphorus. The other colloidal systems were decreasingly effective in the following order: H-bentonite, H-Putnam, and H-humus.

The study of the energy changes associated with pH, total hydrogen, active calcium, and total calcium calculated into bonding energy and into energies of exchange revealed that the weathering of the phosphorus in the apatite was related to the active calcium ions as well as to the active hydrogen of the colloidal system. The colloidal systems arranged in order as effective weathering agents were as follows: Amberlite IR-120, Wyoming bentonite clay, Putnam clay, kaolinite clay, and humus.

Greenberg, A. E., and McGauhey, P. H. CHEMICAL CHANGES IN SEWAGE DURING RECLAMATION BY SPREADING. Soil Sci. 79: 33-39. 1955.

A study of chemical changes in sewage during the reclamation of water from sewage by spreading is reported. The spreading operation was conducted on Hanford fine sandy loam. Samples were collected and analyzed to a depth of 13 feet. The results indicate that quantitative changes in the liquid were few. The concentrations of calcium, magnesium, sodium, and chloride ions remained the same. Potassium decreased by about 50 percent. Ammonia and phosphates were completely removed within the first 4 feet of vertical water travel. Sulfates and bicarbonates increased by about 30 percent. Nitrate-ion concentrations increased by about 200 percent. Explanations for the changes, which were largely due to biological activity in the soil, are proposed.

Harding, R. B. ORGANIC MATTER AND TOTAL NITROGEN IN SOUTHERN CALIFORNIA ORANGE ORCHARD AND ADJACENT VIRGIN SOILS. Soil Sci. 79: 277-282. 1955.

A survey was made of the organic matter and total N contents of the soils of 69 southern California orange orchards and of 14 adjacent, representative virgin soils. There were no marked differences between group 1 orchards (high yield and large-sized fruit) and group 2 orchards (low yield and small-sized fruit) in organic matter or total N contents of the soils. There were, however, significant increases in both organic matter and total N in orchard soils when compared with virgin soils. Most of the increases occurred in the surface 6 inches of soil.

Comparison of the soil of an orchard noncultivated and unmanured for 30 years with the soils of 3 cultivated, manured orchards showed considerably less organic matter and total N in the noncultivated orchard.

Jackman, R. H. ORGANIC PHOSPHORUS IN NEW ZEALAND SOILS UNDER PASTURE: I. CONVERSION OF APPLIED PHOSPHORUS INTO ORGANIC FORMS. Soil Sci. 79: 207-213. 1955.

A study was made of the conversion into organic form in the soil of phosphate topdressed on permanent pasture. Based on the results from 18 field trials, average conversions of 20 to 30 percent were found in the top inch of soil, with higher values of the order of 30-40 percent in yellow-brown loams and podzolic soils from sedimentary rocks. There were, in addition, apparent but statistically unconfirmed conversions at lower soil depths.

On a fertile soil recently formed from alluvium, Manawatu silt loam, there was negligible conversion to organic forms of phosphate applied in sheep's dung or superphosphate.

Lutwick, L. E., MacLean, A. J., and Bishop, R. F. FERTILITY STUDIES ON SOIL TYPES: V. THE EFFECT OF CONTINUED CROPPING IN THE GREENHOUSE ON THE PHOSPHORUS SUPPLYING POWER OF SOILS. Canad. Jour. Agr. Sci. 35: 101-110. 1955.

Four crops of oats and alfalfa were grown on samples of surface soil from 9 farms on each of 10 soil types occurring in the Ottawa district. The treatments, applied each fall at time of seeding were 4-0-10 and 4-10-10 fertilizers at the rate of 400 lb. per acre. Yields, amounts of phosphorus removed by the crops, and available soil phosphorus estimated by Bray's methods were used to evaluate the phosphorus-supplying power of the soils.

For each of the fertilizer treatments, the amounts of phosphorus taken up by the crops tended to decline with continued cropping. In most instances the response to applied phosphorus increased as cropping continued. The relative response to applied phosphorus on the different soils, however, was quite similar in the different years of cropping. The values for acid-soluble plus adsorbed phosphorus, and for adsorbed phosphorus only, tended to decrease with continued cropping. The decline in the extracted forms of soil phosphorus relative to the amount of phosphorus removed by the crops, however, was greater in some soils than in others. Low responses to applied phosphorus were associated with high values for available phosphorus. The correlation coefficients relating to the decreases in available phosphorus and the uptake of phosphorus by the crops were highly significant.

Martin, A. E., and Reeve, R. A RAPID MANOMETRIC METHOD FOR DETERMINING SOIL CARBONATE. Soil Sci. 79: 187-197. 1955.

The theoretical basis of the Passon manometric method for carbonate determinations is discussed and a tentative method is described. Comparative results with manometric and titrimetric methods on 67 soils indicated agreement, the differences being nonsignificant at $P = 0.99$. Reproducibility trials with the two methods showed little difference in variation although the titrimetric method gave closer reproducibility with a soil containing a low amount of carbonate. Grinding of subsamples to pass a 0.5 mm. sieve is considered essential to reduce variation to reasonable levels.

McAuliffe, C., and Bradfield, R. UTILIZATION BY PLANTS OF PHOSPHORUS IN FARM MANURE: III. UPTAKE OF PHOSPHORUS BY SUDAN GRASS FROM MANURE AND SUPERPHOSPHATE INCORPORATED INTO SOIL AT DIFFERENT DEPTHS. Soil Sci. 79: 475-486. 1955.

By tagging with radiophosphorus, the utilization by plants of phosphorus from manure and superphosphate was determined in the field in small concrete frames filled to a depth of 18 inches with Ontario loam and with Erie, Wooster, and Canfield silt loams. Sudan grass was the indicator crop.

Superphosphate or manure applied in 1949 or residual phosphorus from 1926 and 1936 applications of superphosphate did not increase the yield of Sudan grass.

The percentage of phosphorus in the Sudan grass derived from the added manure and superphosphate varied from 15 to 40 percent in the first cutting and from 9 to 37 percent in the third, being dependent upon soil as well as past phosphorus application. In all treatments, there was a decrease with time in the proportion of phosphorus in the plant derived from added fertilizer. The availability of phosphorus from superphosphate and from manure was essentially the same at the first cutting, but by the third cutting the availability of phosphorus from manure exceeded that from superphosphate on all four soils.

McCollum, R. E., and McCaleb, S. B. CHEMICAL PROPERTIES OF SOME COASTAL PLAIN SOILS OF NORTH CAROLINA. Soil Sci. 78: 435-443. 1954.

In a study conducted to evaluate chemical properties of Coastal Plain soils as related to soil series and management, randomized samples from virgin and cultivated soils in Duplin County, N. C., were taken. The samples were analyzed for organic matter, pH, and available calcium, magnesium, potassium, and phosphorus. The data for cultivated soils were evaluated according to soil series and previous crop, and general comparisons with results from virgin soils were made. Although a rather wide range of values was obtained for virgin soils within a series, the results indicated that soil series of the Atlantic Coastal Plain in the virgin condition can be separated into different populations chemically as well as physically.

The data for cultivated soils showed that most of the differences in organic-matter content, pH, and available calcium and magnesium could be attributed to variation between series, and there was little evidence that these properties had been differently affected by management practices. On the other hand, the data for available potassium indicated that different populations exist by both soil series and crop. Available phosphorus in the A_p horizon was more closely related to cropping practices than to soil series. In the B horizon, most of the variation in phosphorus levels was attributable to differences between series. Between-crop variation in both potassium and phosphorus was obviously the result of higher rates of fertilization for crops of high acre value.

Swenson, R. M., and Riecken, F. F. MOVEMENT OF IRON IN THE DEVELOPMENT OF LOESS-DERIVED BRUNIZEM SOILS. Soil Sci. 79: 177-186. 1955.

The distribution of iron in different sized fractions of various horizons of the Minden and Edina soils showed significant changes as a result of the processes of soil formation. Accumulation of lattice iron was greatest in the B_2 horizon of the Edina profile. The movement of iron to the lattice form in the fine clay fraction was not limited to the B_2 horizon but occurred in all horizons studied, with the exception of the surface. Here a larger percentage of the total iron of the horizon was found in the fine clay of the Minden profile than in the fine clay of the Edina profile.

Soil Biology

Eno, C. F., Blue, W. G., and Good, J. M., Jr. THE EFFECT OF ANHYDROUS AMMONIA ON NEMATODES, FUNGI, BACTERIA, AND NITRIFICATION IN SOME FLORIDA SOILS. Soil Sci. Soc. Amer. Proc. 19: 55-58. 1955.

The application of anhydrous ammonia to soil by conventional applicators employing knife-type injectors results in large concentrations of ammonia in a localized area. The effect of these concentrations on the soil population has been evaluated in several ways.

The numbers of fungi and nematodes were reduced by all levels of ammoniacal nitrogen from 136 to 741 p.p.m. Compared to untreated soil, only 0.6 percent of the nematodes and 4.9 percent of the fungi survived when 608 p.p.m. of nitrogen were present in the soil. This level of ammoniacal nitrogen occurs regularly in the retention zone when anhydrous ammonia is applied in the field. The largest reduction in both nematodes and fungi occurred above 365 p.p.m. Field studies showed a drastic reduction in all nematodes in the retention zone. Plant parasitic nematodes were detected during counting. Reestablishment of the nematodes was greatest among the saprophytic species and was of the same character as that following fumigation with conventional nematocides. The economic value of the reduction of plant parasitic nematodes by anhydrous ammonia, applied primarily for its nitrogen content, will require further work on a field basis. Gross elimination of nematodes is not necessary for successful crop production. Thus, it can be seen that in addition to the primary use of anhydrous ammonia as a fertilizer, the destruction of plant parasitic nematodes in the retention zone also may be of value.

Lochhead, A. G., and Rouatt, J. W. THE "RHIZOSPHERE EFFECT" ON THE NUTRITIONAL GROUPS OF SOIL BACTERIA. Soil Sci. Soc. Amer. Proc. 19: 48-49. 1955.

The effect of the growing plant on the balance between certain nutritional groups of soil bacteria is discussed in the light of a paper by Wallace and King who reported findings at variance with those obtained in this laboratory. Since the "rhizosphere effect" is considered to be the influence exerted by the growing plant in its immediate environment, rhizosphere and control samples from field tests should be regarded as a unit. The control samples taken by Wallace and King bore no direct relation to the location of the plants whose rhizosphere effects were under study; their procedure was therefore radically different from that used in this laboratory and consequently any precise comparison of results is vitiated. One of the most characteristic rhizosphere effects is believed to be the preferential stimulation of bacteria requiring amino acids, and data from experiments with a variety of crops are presented.

Starkey, R. L., RELATIONS OF MICRONUTRIENTS TO DEVELOPMENT OF MICROORGANISMS. Soil Sci. 79: 1-14. 1955.

Deficiency of micronutrients in soils results in abnormalities in plants, low yields, poor nutritional value of the plants, and in many cases in crop failure. There is general agreement that provision of adequate amounts of micronutrients to plants is a major soil problem. Microorganisms modify these elements and affect their availability to plants by assimilating them, by oxidation and reduction, by precipitation and solution, and by production of organic complexes of the metals and decomposition of these complexes.

Soil-Plant-Animal Relations

Gill, W. R., and Bolt, G. H. PFEFFER'S STUDIES OF THE ROOT GROWTH PRESSURES EXERTED BY PLANTS. Agron. Jour. 47: 166-168. 1955.

Pfeffer's elaborate and well conducted experiments show the magnitude of pressures exerted by plant roots against external resistances encountered in the soil. These values form the only set of data available at this time.

Since the root has plastic properties, its path will generally be along the line of least resistance. Therefore, high values of axial pressures exerted are only encountered if the root is sufficiently confined in its radial directions.

The observation that wrinkling or folding of the cell walls of the root takes place when the root encounters unsurmountable external resistance suggests a possible diagnostic method of interpreting impeding properties of the soil in terms of the plant itself.

Soil Genesis, Formation, Classification, and Mapping

McKenzie, L. J., and Erickson, A. E. THE USE OF REDOX POTENTIALS IN STUDIES OF SOIL GENESIS. Soil Sci. Soc. Amer. Proc. 18: 481-485. 1954.

Redox potentials have been measured in situ, with variations in time and space, in two well-drained podzols, McBride fine sandy loam, and in a Humic Gley soil, Parkhill loam. In addition, redox potentials were studied in sand columns under an organic layer in a laboratory experiment.

Extremely low potentials persisted late into the growing season in the Parkhill loam, while low potentials were not observed in McBride fine sandy loam or in Marlette loam during May to November. In McBride fine sandy loam and in Marlette loam, the surface horizon gave lower readings than the lower horizons during the summer months. In the Parkhill loam, the A_G horizons gave the lowest readings in the spring.

A redox profile was also observed in a study using sand columns under a humus layer. This was associated with a relatively greater amount of reduced iron in the upper part of a well-drained sand column. It is postulated that this ferrous iron could be dissolved in the upper part of the solum, translocated, and then precipitated when it reached a higher oxidation zone lower in the soil profile. Additional studies are underway to test this hypothesis.

McVickar, J. S. THE PROBLEM AREA AS A BASIS FOR DEVELOPING A SOIL EROSION MAP. Jour. Soil and Water Conserv. 9: 251-254. 1954.

Because of the importance of wind and water erosion in Michigan, it seemed desirable to have a map showing the incidence of such erosion in sufficient detail to give an adequate perspective of the needed control requirements. To accomplish this, a sampling survey method was employed to utilize existing bases in evaluating and delineating the erosion situation in the state. The proceedings developed were successful and can be made applicable, according to the author, to other parts of the region and the United States, provided regional variations in character of farming, farmers, climate, land, soil, and vegetation are taken into account.

Schatz, A., Cheronis, N. D., Schatz, V., and Trelawny, G. S. CHELATION (SEQUESTRATION) AS A BIOLOGICAL WEATHERING FACTOR IN PEDOGENESIS. Pa. Acad. Sci. Proc. 28: 44-51. 1954.

The soil which supports plantlife is itself produced from parentrock material by the action of plants. Organic metal chelates may be viewed as bridging the gap between the organic and inorganic worlds in the soil and elsewhere in Nature. In the process of biochemical weathering, acids no doubt contribute to pedogenesis. However, the abundance of microbial and higher plant products with chelating properties, the marked stability of organic metal coordination covalent complexes, and the wide range of pH over which chelation occurs emphasize the importance of this kind of reaction in pedogenesis. Chelation appears to be an independent function of natural soil organic matter. It may be a major biological weathering factor qualitatively distinct from acidity and possibly under some conditions more significant. Some theoretical and practical implications of this concept are discussed in connection with biological weathering in pedogenesis, edaphic relationships of lichens, mycorrhiza, the Osage orange tree, and practical agriculture.

Rieger, S., and Smith, H. W. SOILS OF THE PALOUSE LOESS: II. DEVELOPMENT OF THE A_2 HORIZON. Soil Sci. 79: 301-319. 1955.

Several soils of eastern Washington and northwestern Idaho were studied to determine the factors responsible for the development of A_2 horizons at unusually great depths in their profiles. Geographically associated soils without A_2 horizons were also studied.

Bulk density, reaction, and textural variations among horizons in the profiles with A_2 horizons are comparable to those in planosols of the Middle West. Organic matter, under both forest and grass cover, usually decreases steadily with depth.

Counts of heavy and light mineral grains from the very fine sand fraction of selected horizons indicate that the soils have developed from two mineralogically distinct parent materials; one, when present, always overlies the other. The upper parts of most of the profiles contain an admixture of volcanic ash. In many profiles, the A_2 occurs immediately above the boundary between the portion of the profile modified by volcanic ash and the portion containing no ash.

Tedrow, J. C. F. CLAY MINERALS IN THREE PODZOL PROFILES. Soil Sci. Soc. Amer. Proc. 18: 479-481. 1954.

Clays from well-developed podzols from gray acid sandstone glacial tills of Kansan, Illinoian, and Wisconsin ages were identified. After removal of the free oxides, the predominant minerals in the clay were interstratified 2:1 layer silicates, quartz, illite, and small quantities of kaolinite. Vermiculite, or chlorite was present in the lower horizons of the older tills. The A_2 horizons tended to be higher in quartz than the B and C horizons. Wisconsin clays were slightly higher in quartz than Illinoian or Kansan. The clays, while showing slight shifts with age and depth, were basically similar.

van der Merwe, C. R., and Heystek, H. CLAY MINERALS OF SOUTH AFRICAN SOIL GROUPS: II. SUBTROPICAL BLACK CLAYS AND RELATED SOILS. Soil Sci. 79: 147-158. 1955.

The clay minerals of the colloids of the subtropical black clays and related soil groups were investigated by x-ray diffraction methods and differential thermal analysis. The data obtained and the chemical composition of these colloids previously analyzed were compared. The results confirm the morphological classification of these soils.

The internal drainage of these black clays is generally poor, and without exception montmorillonite is the predominant, and in many instances the only, clay mineral identified at all levels of the profiles. Whenever the norite soil material is slightly diluted with foreign material the clay mineral of the resultant red soil is predominantly kaolin, formed by decomposition of montmorillonite. At the relatively lower altitudes and associated higher temperatures in the temperate region, black immature and red mature soils with soil kaolin as clay mineral are formed from dolerite, instead of montmorillonitic black clays, which develop at higher altitudes associated with colder climates.

HYDROLOGY

General

Anderson, H. W. DETECTING HYDROLOGIC EFFECTS OF CHANGES IN WATERSHED CONDITIONS BY DOUBLE-MASS ANALYSIS. Amer. Geophys. Union Trans. 36: 119-125. 1955.

Double-mass plotting of hydrologic events against meteorological control is one way of detecting the effects of changes in watershed condition. This method of plotting showed that changes in sedimentation and peak inflow were associated with the occurrence of wildfires in the watershed above Gibraltar Reservoir, Santa Ynez Watershed, Calif. A meteorological control was calculated from the maximum daily precipitation of a storm and the precipitation during an antecedent period. Sedimentation of the reservoir and peak inflow increased markedly following the wildfires of 1932 and 1933. Then they decreased as the watershed recovered from the fires. Using the same method, no change in the total annual inflow was detected. The effects of changes in watershed condition must be taken into account in estimating long-term average sedimentation and flood frequency from the short-term records now available.

Boyer, M. C. ESTIMATING THE MANNING COEFFICIENT FROM AN AVERAGE BED ROUGHNESS IN OPEN CHANNELS. Amer. Geophys. Union Trans. 35: 957-961. 1954.

The Manning coefficient of roughness in open channels plays an important role in the determination of discharge by slope-area methods. It is not a constant for different depths of flow in a channel, but varies as the depth to the one-sixth power, as well as in some relation to the average height of bed roughness. Through use of the logarithmic velocity-distribution equation for flow in open channel, these relations can be evaluated. When the Manning coefficient is expressed in terms of height of channel roughness, its determination is much simplified in the field as roughness can be estimated with considerable error without materially affecting the coefficient.

As a second means of determining the Manning coefficient, the distribution of velocity in the vertical at gaging stations provides a useful tool. The logarithmic velocity-distribution equation and the Manning equation can be solved for the Manning coefficient in terms of the ratio of the velocities at two-tenths and eight-tenths the depth. The coefficient thus determined can be used in the computation of main-channel flows following floods that could not be measured by the current meter.

Curves of relation between the Manning coefficient and the ratio of average depth to average height of roughness and between the coefficient and the ratio of the velocities at 0.2 and 0.8 depth are presented.

Hantush, M. S., and Jacob, C. E. NONSTEADY GREEN'S FUNCTIONS FOR AN INFINITE STRIP OF LEAKY AQUIFER. Amer. Geophys. Union Trans. 36: 100-112. 1955.

Solutions are obtained for the nonsteady flow to a well in an infinite-strip of leaky aquifer whose boundaries are maintained either at a constant head or at a vanishing flux. These solutions are used to deduce the corresponding solutions for nonleaky aquifers. Also they are used to obtain the nonsteady Green's functions for the infinite-strips. Green's functions are tabulated for infinite quadrants and half-planes.

Hantush, M. S., and Jacob, C. E. NONSTEADY RADIAL FLOW IN AN INFINITE LEAKY AQUIFER. Amer. Geophys. Union Trans. 36: 95-100. 1955.

The nonsteady drawdown distribution near a well discharging from an infinite leaky aquifer is presented. Variation of drawdown with time and distance caused by a well of constant discharge in confined sand of uniform thickness and uniform permeability is obtained. The discharge is supplied by the reduction of storage through expansion of the water and the concomitant compression of the sand, and also by leakage through the confining bed. The leakage is assumed to be at a rate proportional to the drawdown at any point. Storage of water in the confining bed is neglected. Two forms of the solution are developed. One is suitable for computation for large values of time and the other suitable for small values of time. This solution is compared with earlier solutions for slightly different boundary conditions.

Hantush, M. S., and Jacob, C. E. STEADY THREE-DIMENSIONAL FLOW TO A WELL IN A TWO-LAYERED AQUIFER. Amer. Geophys. Union Trans. 36: 286-292. 1955.

In part I, a solution is obtained for the potential distribution induced by a well screened in uniform sand and pumping from it at a constant rate. This sand is overlain by another sand of different permeability, over whose upper surface the potential is uniform. The potential remains constant also at the common outer boundary of both sands which is concentric with the well. A sample calculation is made for an assumed set of the parameters of the system. For all practical values of the parameters in leaky aquifers, the validity of earlier assumptions made to reduce three-dimensional problems to two dimensions is verified.

In part II, the solution obtained is for the case where the steadily discharging well is screened in the upper of the two sands. Here, the two layers of sand are bounded above and beneath by impervious strata. The other boundary conditions are the same as those stipulated for the problem described in part I. From the general solution, the potential distribution is obtained for the flow towards a well partially penetrating a single sand.

Hosler, C. L., and Hosler, C. R. AN INVESTIGATION OF THE FREEZING OF WATER IN CAPILLARIES. Amer. Geophys. Union Trans. 36: 126-132. 1955.

To isolate the factors governing the freezing point of cloud and precipitation elements, experiments have been made to measure the effects of physical dimension and of certain ions in solution upon the freezing temperature of water in glass capillaries. The results of these experiments indicate that the freezing point of water in capillaries is independent of the volume or of the interface area and that the radius of the capillary tubing is the only physical dimension that affects the freezing point of water contained in it. The amount of supercooling necessary to induce freezing can be either increased or diminished by the addition of certain ions in solution. The magnitude and sign of the change in freezing point are functions of the type of ions in solution, the molar concentration of the ions, and the capillary radius.

Love, L. D. THE EFFECT ON STREAM FLOW OF THE KILLING OF SPRUCE AND PINE BY THE ENGELMANN SPRUCE BEETLE. Amer. Geophys. Union Trans. 36: 112-118. 1955.

An outbreak of the Engelmann spruce beetle on the White River Plateau of western Colorado killed the Engelmann spruce and lodgepole pine on a considerable portion of the 762-square mile drainage basin of White River above the town of Meeker, Colo. Statistical analyses were made to compare streamflow and water content of snow for White River with similar measurements made for the 206-square mile drainage basin of Elk River above Clark, Colo. The analyses show that the flow of White River increased after the beetle outbreak, and this increase is attributed to reduced interception of snow and to reduced transpiration by the beetle-killed trees. Total annual streamflow of White River was compared for three periods: (1) the 1937-40 water years before the killing of the spruce and pine; (2) the 1941-46 water years during which the beetle outbreak was most active; and (3) the 1947-51 water years after the killing of the mature and overmature spruce and pine had been completed. The average annual streamflow increased by 1.22 inches during 1941-46 and by 2.28 inches during 1947-51 as compared to 1937-40 after adjustment was made for climatic fluctuations.

Remson, I., and Lang, S. M. A PUMPING-TEST METHOD FOR DETERMINATION OF SPECIFIC YIELD. Amer. Geophys. Union Trans. 36: 321-325. 1955.

The specific yield of a water-table aquifer is one measure of the amount of water within the aquifer that is available for recovery (development). It is expressed as a percentage or decimal fraction of the total volume of material of which the aquifer is composed. The specific yield may be determined during the course of an equilibrium pumping test by comparing the volume of dewatered material in the cone of depression with the total volume of discharge water. An equation is developed theoretically that expresses the volume of dewatered material in terms of test data. A related equation indicates the magnitude of losses at the pumped well. These equations were tested by applying them to test data tabulated in ground-water literature.

Todd, D. K. UNSTEADY FLOW IN POROUS MEDIA BY MEANS OF A HELE-SHAW VISCOUS FLUID. Amer. Geophys. Union Trans. 35: 905-916. 1954.

The problem of unsteady flow in porous media was investigated for the two-dimensional case by a model analogy consisting essentially of an oil flowing through a narrow glass channel. The apparatus, known as a Hele-Shaw viscous fluid model, avoided the difficulties of measuring flow in porous media. The model was calibrated by steady flow measurements.

Unsteady flows, composed of sudden releases of oil into and out of the channel, were recorded and analyzed. Results were presented in graphical form using dimensionless parameters. Agreement with numerical solutions of the basic nonlinear differential equation, as applied to gas flow through porous media, was obtained. A study of a series of solitary sine waves was made as a model analogy of the damping of a flood hydrograph in a ground-water table adjacent to a stream. Results indicated that the damping rate was independent of both amplitude and period of the flood wave and that the damping distance was a function of the period but not of the amplitude.

Sedimentation

Flaxman, E. M., and Hobba, R. L. SOME FACTORS AFFECTING RATES OF SEDIMENTATION IN THE COLUMBIA RIVER BASIN. Amer. Geophys. Union Trans. 36: 293-303. 1955.

An analysis of stockpond sedimentation-survey data and related watershed-survey data in the Columbia River Basin revealed that five factors account for 80 percent of the variation in observed sediment in the stockponds studied. These factors include the amount of land subject to accelerated erosion, the original pond storage capacity per square mile of watershed, age of pond, size of watershed, and amount of average annual precipitation. The sedimentation surveys were made during late summer and fall of 1951 in connection with the development of an agricultural program for the Basin by the U. S. Department of Agriculture. The purpose was chiefly twofold: (1) to provide information on rates of sedimentation in areas where little or no data were available; and (2) to determine the reduction in sediment which may be achieved by the application of conservation practices. The field data, survey methods, and results of data analysis are given.

Wolman, M. G. A METHOD OF SAMPLING COARSE RIVER-BED MATERIAL. Amer. Geophys. Union Trans. 35: 951-956. 1954.

This determination of the size of material on the bed of a stream is based upon an analysis of the relative area covered by particles of given sizes. The method is applicable to those rivers which flow on coarse material and may be waded during low water. Sampling consists of measuring on the basis of a grid system, the intermediate axis of 100 pebbles picked from the bed of the channel. From this sample a frequency distribution is drawn from which the desired size parameters are read. The advantages of the areal sampling procedure over bulk sampling are (1) that it is applicable to very coarse materials, and (2) that it provides a more representative sample of an entire reach of a stream.

Ground Water

Cushman, R. L., and Halpenny, L. C. EFFECT OF WESTERN DROUGHT ON THE WATER RESOURCES OF SAFFORD VALLEY, ARIZONA, 1940-1952. Amer. Geophys. Union Trans. 36: 87-94. 1955.

Records of precipitation, runoff in the Gila River, ground-water withdrawals for irrigation, and changes in ground-water level in Safford Valley, Ariz. provide a basis for noting the effect of wet and dry periods on the hydrologic cycle. An unusually wet period, 1940-41, was followed by a period of drought, 1942-52. The irrigable area is limited by natural causes, the area irrigated with surface water is effectively limited by court decree, and less than 1,000 acres are irrigated exclusively from wells. Thus relatively little expansion in this irrigated area has occurred during the period concerned to obscure the climatic effects, although cultivation has been more intensive in recent years and the water demand has been correspondingly larger. The wet period of above-normal streamflow and ground-water levels provided a cushion that delayed and reduced the effects of the drought. Since the ground-water storage in the valley is relatively small, however, withdrawals of ground water as a supplemental supply for irrigation eventually lowered water levels sufficiently to reduce well yields. The concentration of dissolved mineral matter increased in the remaining ground water, making it less desirable for irrigation use than previously.

Hantush, M.S., and Jacob, C. E. PLANE POTENTIAL FLOW OF GROUND WATER WITH LINEAR LEAKAGE. Amer. Geophys. Union Trans. 35: 917-936. 1954.

Potential distributions are found for steady wells idealized as sinks, and tapping uniform confined aquifers into which there is leakage in proportion to the drawdown. Several plane regions are treated, along whose boundaries the potential, flux, or both are specified. The ratio of the conductivity of the aquifer to that of the confining bed is assumed very large so that the refraction of flow lines may be assumed complete as they cross the contact. The leakage, thus considered vertical through the confining bed, is assumedly distributed throughout the thickness of the aquifer as it thus augments or diminishes the horizontal flow, which is then treated as two dimensional.

Starting with the fundamental solution for an infinite plane region, the solutions for other plane regions are built up by the method of images. The Green's functions for leaky systems are thus obtained for infinite half-planes, infinite quadrants, infinite strips, infinite half-strips, and rectangles. Several graphs are given showing potential distributions in special cases and showing the magnitude of drawdown at the well face for various values of the parameters

Remson, I., and Fox, G. S. CAPILLARY LOSSES FROM GROUND WATER. Amer. Geophys. Union Trans. 36: 304-310. 1955.

A method is presented for estimating the discharge of ground water by evapotranspiration of water rising from the water table by capillary. "Potential capillary waterloss" is defined as a measure of the ability of the capillary interstices of a soil to raise water from the water table to the ground surface. Published equations describing soil-moisture movement and published graphs relating capillary conductivity and capillary potential are used to derive expressions of the relation between "potential capillary waterloss" and depth to the water table in a given soil. On the basis of these theoretical relations, graphs are drawn that show how the depth to the water table affects the ability of a particular soil to raise water to the ground surface under given conditions. The application of these methods is discussed in relation to the estimation of ground-water losses by capillary rise, the determination of potential evapotranspiration, and the analysis of soil-tank data. Their essential agreement with empirical profiles of capillary potential obtained in soil tanks demonstrates their usefulness.

Hydraulic Structures

Minshall, N. E. EVALUATION OF GULLY CONTROL STRUCTURES. Agr. Engin. 36: 35-37. 1955.

Continued neglect of maintenance will eventually result in failures requiring extensive repairs. An educational program, either in the form of a handbook or series of articles for local papers, is necessary to insure proper maintenance.

Drop inlets should be equipped with properly designed trash racks. Where climate and soil conditions will permit the establishment and maintenance of a good sod, a sod flume might well replace a concrete or masonry structure on small watersheds or low overfalls. Considerable study will be necessary to determine the limitations for such sod flumes.

SOIL AND WATER MANAGEMENT

General

Aslyng, H. C., and Kristensen, K. J. INVESTIGATIONS ON THE WATER BALANCE IN DANISH AGRICULTURE. Royal Veterinary and Agr. Col. Yearbook, pp. 48-90. 1953.

Lysimeter experiments were carried out in 1944, 1945, 1952, and field experiments in 1951 and 1952 to determine evaporation and moisture tension on bare soil and soil under crops.

Evaporation from areas in different crops was determined as rainfall from April 1 to such time in the fall when the soil was saturated to the same field capacity as in the spring. Moisture determinations were made with tensiometers placed at different depths. Evaporation losses were the same for oats irrespective of the size of the crop. Evaporation increased slightly in fodder beets as the yield increased. Frequent clipping of alfalfa and a clover-grass mixture had little effect on evaporation.

Blaney, H. F. CONSUMPTIVE-USE REQUIREMENTS FOR WATER. Agr. Engin. 35: 870-873. 1954.

This paper describes the Blaney-Criddle method of determining consumptive use of water for the irrigated areas of the Western States. The Blaney-Criddle and Lowry-Johnson methods were used to estimate consumptive use for some 4 million acres of irrigated land in the Columbia River Basin. The values derived by these two indirect methods agree very closely with the measured values. It is believed that either method properly used will yield reliable estimates of net consumptive use for areas where direct measurements are not available.

Bloodgood, D. W., Patterson, R. E., and Smith, R. L., Jr. WATER EVAPORATION STUDIES IN TEXAS. Tex. Agr. Expt. Sta. Bul. 787. 1954.

This bulletin contains a complete compilation of all known data on water evaporation in Texas. It also contains information on proper installation and operation of evaporation stations, and discusses procedures and coefficients to use in converting pan evaporation losses to natural lake or reservoir losses.

Bouyoucos, G. J. ELECTRICAL RESISTANCE METHODS AS FINALLY PERFECTED FOR MAKING CONTINUOUS MEASUREMENT OF SOIL MOISTURE CONTENT UNDER FIELD CONDITIONS. Mich. Agr. Expt. Sta. Quart. Bul. 37: 132-149. 1954.

Two electrical resistance methods have been developed for making a continuous measurement of soil moisture under field conditions. One method employs a plaster-of-paris block and the other a nylon unit encased in plaster-of-paris casting. For greater durability of the plaster-of-paris, both units are impregnated with a nylon liquid plastic. Both units are based on the same principle. The effective range of the plaster-of-paris block is from field capacity to somewhat beyond the wilting point of plants. The effective range of the nylon plaster-of-paris encased units is from near saturation to a point above the air-dry condition.

In comparison with the tensiometer method, the nylon unit begins to function satisfactorily at as high a moisture content as does the tensiometer. The nylon unit, therefore, is as sensitive as the tensiometer method in measuring moisture at the higher levels of water content.

Bremner, J. M. NITROGEN TRANSFORMATIONS DURING THE BIOLOGICAL DECOMPOSITION OF STRAW COMPOSTED WITH INORGANIC NITROGEN. Jour. Agr. Sci. 45: 469-475. 1955.

Nitrogen transformations during decomposition of straw composted with ammonium carbonate were studied by following the changes in (a) the amounts of inorganic and organic nitrogen; (b) the amounts of ammonia-, volatile base-, a-amino- and amino sugar-N liberated by acid hydrolysis of the organic nitrogen complexes; and (c) amino acid composition of acid hydrolysates of the composts.

Synthesis of organic nitrogen during the biological decomposition of straw composted with ammonium carbonate is not accompanied by any gross change in the distribution of the forms of organic nitrogen. A large fraction of the organic nitrogen synthesized is in the form of protein; a smaller fraction is in the form of amino sugar.

Carlson, C. A., and Pierce, R. S. THE FIELD MAXIMUM MOISTURE CONTENT. Soil Sci. Soc. Amer. Proc. 19: 81-83. 1955.

The field maximum moisture content is defined as the naturally occuring wet limit of a soil or soil layer in its natural position. Values were obtained by selecting recurring peak values from daily records of soil-moisture content. For most soils the values tended to coincide with the 0.06 atmosphere soil-moisture tension values of core samples. In poorly drained soils the field maximum approached the total pore volume. The field maximum helps characterize the full range of naturally occurring soil-moisture content.

De, P. K., and Digar, S. INFLUENCE OF THE RICE CROP ON THE LOSS OF NITROGEN GAS FROM WATERLOGGED SOILS. Jour. Agr. Sci. 45: 280-282. 1955.

The investigation shows that when ammonium sulphate or oil cake was applied to cropped rice soils 4 weeks after transplantation, a considerable amount of the added nitrogen was lost as gas. This loss, however, was less than the loss that took place when the crop was absent. Placement of ammonium sulphate 3 inches below the soil surface reduced the loss of nitrogen, but did not significantly increase the crop yield. Gases evolved from cropped rice soils, whether unmanured or treated with ammonium sulphate, were free from hydrogen and contained practically no methane, while those formed in the uncropped soil under similar treatments contained large volumes of these two gases.

Gilbert, M. J., and van Bavel, C. H. M. A SIMPLE FIELD INSTALLATION FOR MEASURING MAXIMUM EVAPOTRANSPIRATION. Amer. Geophys. Union Trans. 35: 937-942. 1954.

Soil-filled gasoline drums were used to measure maximum evapotranspiration at Waynesville, N. C. Installation involved no mechanical devices, and maintenance was at a minimum. Water was added manually to prevent water supply to the plants from becoming a limiting factor. Tensiometers were used to indicate when water was needed. Tanks were placed in the center of areas of the same vegetation. Data for 1 year under grass cover are presented and compared with values calculated from Thornthwaite's and Penman's formulas. The latter appears, upon statistical analysis, to fit the data better than the former.

Haise, H. R., Haas, H. J., and Jensen, L. R. SOIL MOISTURE STUDIES OF SOME GREAT PLAINS SOILS: II. FIELD CAPACITY AS RELATED TO 1/3-ATMOSPHERE PERCENTAGE, AND "MINIMUM POINT" AS RELATED TO 15- AND 26-ATMOSPHERE PERCENTAGES. Soil Sci. Soc. Amer. Proc. 19: 20-25. 1955.

Values for field capacity and the "Minimum point" were abstracted under arbitrary standards from a large number of soil samples taken for 30 years at 11 locations. Field capacity was correlated with the 1/3-atmosphere percentage and the minimum point with 15- and 26- atmosphere percentages. Spring wheat was the principal crop grown although at some locations winter wheat and rye were included.

Although there was a highly significant correlation between field capacity and the 1/3-atmosphere percentages, the regression coefficient was approximately 0.5 for all depths except the surface. The relatively low values for field capacity were attributed to depth of wetting which occurred under intermittent and limited rainfall.

Hoglund, C. R. SOIL CONSERVATION IN MICHIGAN. Mich. Agr. Expt. Sta. Spec. Bul. 394. 1955.

The purpose of this study was to explore the progress and problems of Michigan farmers in adopting soil and water conservation practices from the standpoint of indicating additional methods that could be used in attaining greater application of improved practices. One hundred and fifty seven planned farms and 119 nonplanned farms in Barry, Hillsdale, Livingston, Osceola, and Tuscola Counties were studied. Planned farms are those cooperating in a soil conservation district program.

The study showd that 70 to 80 percent of the cooperators in each of the five soil conservation districts believed their farm plans were workable. However, much work was needed to put component parts of the plans into operation on many farms. The other 20 to 30 percent had decided that the changes in farm organization and practices provided for in their initial farm plans were too drastic or did not provide sufficient flexibility. From 10 to 30 percent of the cooperators in each of the five districts had adopted essentially all of the component parts of the farm plans. An additional 50 percent or more had made substantial progress in applying one or more parts of the plans. This progress was made during 5 to 7 years preceding 1952.

Cooperators in each of the districts, except those on cash-crop farms in Tuscola, attained about 60 percent of the planned acreage of sod crops--the basic part of every farm plan. Cash-crop cooperators in Tuscola County increased the average acreage in sod crops by 25 percent between the time the plan was prepared and 1952, but they attained only a third of the planned acreage. Those who had dairy enterprises more nearly attained the planned acreage of sod crops. Noncooperators in each of the three districts where they were studied made only minor changes in acreages of hay and rotation pasture between 1945-47 and 1952.

Kenworthy, A. L. EFFECT OF SODS, MULCHES AND FERTILIZERS, IN A CHERRY ORCHARD ON PRODUCTION, SOLUBLE SOLIDS AND ON LEAF AND SOIL ANALYSES. Mich. Agr. Expt. Sta. Tech. Bul. 243. 1954.

The influence of combinations of sods, fertilizers, and mulches in a Montmorency cherry orchard was determined in relation to yield, soluble solids, leaf composition, and soil analysis.

Sods of chewing fescue and Kentucky blue grass without a mulch resulted in a 50-percent decrease in yield. When a mulch of either straw or alfalfa was combined with the sods, the yield was essentially equal to that obtained by clean cultivation without a mulch. The highest yield was obtained with the combination of clean cultivation with a mulch of straw or alfalfa.

Moyle, R. C., and Zahner, R. SOIL MOISTURE AS AFFECTED BY STAND CONDITIONS. U. S. Dept. Agr. So. Forest Expt. Sta. Occasional Paper 137. 1954.

During the summer of 1953, soil-water depletion was measured under six different forest conditions in south Arkansas. Three forested sites were left undisturbed, while three others were variously treated to remove vegetation. Where pine or hardwood stands with a stocking of 70 to 100 square feet of basal area were undisturbed, water was removed from the ground rapidly with the onset of hot dry weather. On plots where large cull hardwoods were deadened, and where all other living vegetation was removed, soil water remained relatively high throughout the summer.

The summer was a dry one, and rainfall only moderately affected the total moisture on the undisturbed sites. Evapotranspiration quickly depleted the soil of water added by these showers. Soil-water depletion was greater where all vegetation had been removed than where only culls had been deadened, but this difference was apparent only in the surface layers. Below the effective zone of evapotranspiration on these sites, soil water remained at a rather constant high level.

Shockley, D. R. CAPACITY OF SOIL TO HOLD MOISTURE. Agr. Engin. 36: 109-112. 1955.

Most irrigated crops have a common moisture-extraction pattern with about 40 percent of the extracted moisture coming from the upper quarter of the root zone, 30 percent from the second quarter, 20 percent from the third quarter, and 10 percent from the bottom quarter. When the available moisture in a significant portion (approximately 25 percent) of the root-zone profile is exhausted, the plant will be unable to extract sufficient moisture from the remaining portion to maintain rapid crop growth during maximum transpiration.

Total readily available moisture is limited to the amount of moisture that may be extracted from the root-zone soil profile before the available moisture content of a significant portion (approximately 25 percent) of the soil is exhausted. This is governed by the texture of various layers of the profile and the moisture-extraction pattern.

TRAM values should be discounted by about 1 inch to allow for a safety factor.

Smith, R. M. Henderson, R. C., and Tippit, O. J. SUMMARY OF SOIL AND WATER CONSERVATION RESEARCH FROM THE BLACKLAND EXPERIMENT STATION, TEMPLE, TEXAS, 1942-53. Tex. Agr. Expt. Sta. Bul. 781. 1954.

Twenty years of runoff, erosion, and related measurements have been completed at the Blackland Experiment Station. The present bulletin includes detailed data covering 12 years.

Infiltration studies showed the effectiveness of straw mulch as well as grass cover in preventing surface soil sealing and early runoff. With water applied at 3.3 inches per hour, runoff rates greater than 80 percent of the applied rate were reached in all cases during wet runs, after a constant infiltration rate was reached. For Austin clay, the constant rates varied from 0.25 to 0.59 inch per hour; and for Houston black clay, from 0.08 to 0.27 inch. Under natural rainfall conditions the minimum rates for saturated soil probably would be less.

Twenty years of record on small plots and 15 years on field-scale plots show that water and soil losses on an annual basis are related closely to total rainfall on land in row crops. With small grain, clover, or grass, the relation is not so well defined. On a seasonal basis, also, heaviest losses correlate with total rainfall, with a peak in May and a smaller peak in September. On row-crop land, losses in March, April, and June, as well as in May, are heavier than for the September peak.

Twenty years of records on small plots, as well as indirect comparisons with large field-scale plots, indicate that length of slope tends to be a minor factor influencing sheet erosion. Soil and treatment variability or approximate contouring, normally overshadow slope length effects. Runoff tends to be slightly less on long slopes because of the extra time for infiltration. Soil loss per inch of runoff is higher on long slopes.

Percent of slope has little effect on runoff but a big influence on erosion. Individual field-scale plots of varying slope, from 1.39 to 3.01 percent, provide evidence in general agreement with results from other locations that erosion increases as slope percent to approximately the 1.4 power.

The effect of crops on runoff and erosion depends primarily on the amount of cover provided during critical seasons. No consistent differences between corn and cotton have been shown. Small grains alone or with sweetclover have been effective because their heaviest growth gives maximum protection during March, April, and May, the period of maximum rainfall. With ordinary turning of residues, 1 year of corn or cotton following small grain has lost as much soil and water as 1 year of row crop following a row crop. Sweetclovers alone have given good control. Theory and trends in the data favor small grain with sweetclover over either crop grown alone. Untrampled bermudagrass sod in small plots has given the maximum of water intake and of erosion control. Under pasture conditions, especially with heavy trampling on wet soil, observations indicate that heavy runoff is to be expected even with dense sod that will prevent soil erosion.

van't Woudt, B. D. ON A HILLSIDE MOISTURE GRADIENT IN VOLCANIC ASH SOIL, NEW ZEALAND. Amer. Geophys. Union Trans. 36: 419-424. 1955.

Data on a moisture gradient in the surface soil on a slope of about 30° and about 50 feet long in a small valley are presented. Moisture increases more or less gradually from the top to the foot of the slope. Three factors seemed to contribute toward the establishment of this gradient: (1) an increase from the top to the bottom of the slope in the depth of soil wetted during a rainstorm as a result of (a) surface- and subsurface stormflow, and (b) incomplete wetting by rain of the surface soil on the upper half of the slope because of a resistance to wetting generally exhibited by the soil in this position; (2) an increase in moisture retention capacity of the soil with descent on the slope; and (3) a decrease in evaporation from the soil surface with descent on the slope apparently because of decreased exposure to air currents.

Veihmeyer, F. J., and Hendrickson, A. H. DOES TRANSPIRATION DECREASE AS THE SOIL MOISTURE DECREASES? Amer. Geophys. Union Trans. 36: 425-428. 1955.

This paper gives results obtained from a prune tree and from a pine tree grown in a suspended tank that permitted the obtaining of a continuous record of moisture loss from the soil. Additional results from field trials with pine, oak, and manzanita on a watershed area and from apricot and prune trees under cultivation show that the rate of moisture extraction from the soil is not influenced by the water in the soil so long as the latter is above the permanent wilting percentage.

Fertilizers and Soil Fertility

Baker, A., and Brady, N. C. YIELD AND MINERAL COMPOSITION OF ALFALFA AND SUNFLOWERS AS INFLUENCED BY THE DEGREE OF REACTION OF CALCIUM CARBONATE WITH TWO ACID SOILS. Soil Sci. Soc. Amer. Proc. 18: 404-408. 1954.

The comparative effects of reacted and unreacted $CaCO_3$ in two acid soils on the growth and nutrient uptake of alfalfa and sunflowers were determined. The soils, both Mardin silt loams, had pH values of 4.6 and 5.5, respectively, and $CaCO_3$ was applied at the rate of 1.35 tons per 2×10^6 pounds.

Reaction of $CaCO_3$ with the more acid soil increased the yields and calcium contents of both alfalfa and sunflowers. On the less acid soil, reaction of the $CaCO_3$ with the soil was not effective in increasing the yield of either plant, although the calcium content of both plants was higher where $CaCO_3$ had been allowed to react with the soil before planting. Plant analyses showed a better relationship between manganese content and yield than that of any other element investigated.

Bates, R. P. EFFECTS OF FERTILIZER ON OAT, WHEAT AND BARLEY GRAIN YIELDS AT THE BLACKLAND STATION 1954. Tex. Agr. Expt. Sta. Prog. Rpt. 1746. 1955.

The main effects of P_2O_5 show that 30 pounds significantly increased barley and wheat yields. The main effects of phosphorus on oats were not significant. In general, Mustang oats and Cordova barley plots which received 60 pounds of P_2O_5 per acre began heading 3 or 4 days earlier than plots with no phosphorus. This difference was not shown by Quanah wheat.

Bennett, O. L. Longnecker, T. C., and Gray, C. A COMPARISON OF THE EFFICIENCY OF EIGHTEEN SOURCES OF PHOSPHATE FERTILIZER ON HOUSTON BLACK CLAY. Soil Sci. Soc. Amer. Proc. 18: 408-412. 1954.

A 5-year study was made to determine the efficiency of 18 phosphate fertilizers and amendments in 3 by 3 foot soil frames under simulated field conditions. A uniform application of 120 pounds of P_2O_5 per acre from each source of phosphorus was made. Treatments were set up in two identical series, one cropped to legumes and the other to grass.

Total yields were taken on each harvest, and chemical analyses were made on legumes and Sudan grass. Total yields and chemical composition indicated: (1) Most soluble forms of phosphate fertilizers gave significant increases in yield for both grasses and legumes. (2) Phosphate materials such as colloidal phosphate, deflourinated rock, and tricalcium phosphate were of little value on this type of soil, although defluorinated rock appeared to be better than the other two. (3) Such materials as sodium silicate and magnesium nitrate had very little effect on yield when used alone. When sodium silicate was used in combination with 20-percent superphosphate, a slight depressing effect on yield was noted. (4) Plant analyses showed very little differences due to source of phosphorus. (5) Sodium pyrophosphate and monoammonium phosphate produced higher yields on the average than 20 percent superphosphate or 45 percent superphosphate, but the differences were not significant at the 5 percent level.

Bentley, C. F., Hoff, D. J., and Scott, D. B. FERTILIZER STUDIES WITH RADIOACTIVE SULPHUR. Canad. Jour Agr. Sci. 35: 264-281. 1955.

Sulphur fertilization studies with grain and legume crops at 22 Alberta locations, 1950-52, are reported. Na_2SO_4 containing S^{35} as well as several different sulphur containing fertilizers were used.

Sulphur deficiency is erratic but important in Alberta's gray soils zone. The materials analyzed were generally low in this element compared to similar materials from other regions. Previous plot history and current fertilization both strongly affected the sulphur content of crops, especially of grain straws. Large proportions of the sulphur in crops came from fertilizer applied broadcast and considerable amounts were taken up from placements at 10- and 22-inch depths. No evidences of radiation injury from S^{35} were found.

Blue, W. G., and Eno, C. F. DISTRIBUTION AND RETENTION OF ANHYDROUS AMMONIA IN SANDY SOILS. Soil Sci. Soc. Amer. Proc. 18: 420-424. 1954.

Anhydrous ammonia was applied to several sandy soils which are typical of many soils in Coastal Plain areas. Applications of 58, 115, and 258 pounds per acre of ammonia nitrogen were made at a depth of approximately 5 inches with the injector feet set 13.5 inches apart. Studies were made of the distribution of ammonia around the injection line and of its retention by these soils.

The ammonia was concentrated in zones from 2 to 8 inches wide, depending on the soil-moisture content. Most of the ammonia was usually concentrated in a zone 3 inches wide at rates of application as high as 258 pounds per acre of nitrogen. This resulted in a very high concentration of ammonia at the injection line. The retention was somewhat variable, but in only one instance, at the 58 pounds per acre rate of application, was nitrogen found which equaled that applied. On several soils, losses were shown even at the 58-pound-per-acre application of nitrogen.

Brenes, E. J., Miller, R., and Schmehl, W. R. FERTILIZER VALUE OF RHENANIA-TYPE PHOSPHATES IN GREENHOUSE EXPERIMENTS. Agron. Jour. 47: 77-81. 1955.

The comparative availabilities of a finely ground Rhenania-type phosphate and concentrated superphosphate in six calcareous western soils were studied in a greenhouse experiment with millet as the test crop. Using dry-matter production, total phosphorus uptake, and measurements of available soil phosphorus as criteria, the availability of the Rhenania-type phosphate was equal to that of concentrated superphosphate. The effect of granulation upon the effectiveness of Rhenania-type phosphates was also studied. Here granualation decreased their availability in calcareous soils.

From the results obtained, it was suggested that a Rhenania-type phosphate becomes available largely through the formation of an end product processing an extensive phosphate surface. Within limits, the finer the fertilizer product, and the more thorough the mixing with the soil, the greater will be the surface phosphate and the available soil phosphorus.

Brown, A. L. EFFECT OF SEVERAL INSECTICIDES OF AMMONIFICATION AND NITRIFICATION IN TWO NEUTRAL ALLUVIAL SOILS. Soil Sci. Soc. Amer. Proc. 18: 417-420. 1954.

Columbia fine sandy loam and Yolo loam were incubated in the laboratory at 15-percent moisture and five rates (0-, 0.0005-, 0.005-, 0.05-, and 0.5- percent active ingredient) of insecticide. The insecticides used were, DDT, aldrin, dieldrin, lindane, heptachlor, and chlordane. All insecticides were applied as wettable powder formulations. Ammonia and nitrate were determined after 15, 30, and 60 days of incubation.

In general, the results seem to indicate that rates of insecticide of 0.05 percent or greater will inhibit nitrification in some soils. DDT is the least toxic to the nitrifiers of the insecticides studied, while aldrin, dieldrin, and chlordane are the most toxic. Lindane and heptachlor occupy an immediate toxicity. The significance of the results is discussed.

The rates of insecticide required to produce an effect on nitrification and ammonification are greatly in excess of common rates of application for the materials studied.

Caldwell, A. C., Hustrulid, A., Hammers, F. L., and MacGregor, J. M. THE ABSORPTION OF PHOSPHORUS FROM RADIOACTIVE PHOSPHATE FERTILIZERS APPLIED TO ESTABLISHED MEADOWS I. EFFECT OF SOURCE, RATE, AND TIME OF APPLICATION. Soil Sci. Soc. Amer. Proc. 18: 440-443. 1954.

In the spring of 1950 radioactive superphosphate and fused tricalcium phosphate at rates of 40 and 120 pounds of P_2O_5 per acre were applied as a topdressing to alfalfa on two fields of Waukegan silt loam. Superphosphate was more effective than fused tricalcium phosphate in supplying phosphorus to the plant but differences became less with time. The yield and phosphorus content of alfalfa were increased by both sources of phosphorus.

Similar trials were conducted in 1951 on the same soil type with the added treatment of potassium to the heavier phosphate application. Again superphosphate was superior to fused tricalcium phosphate as a source of phosphorus for alfalfa. The uptake of phosphorus was increased by the addition of potassium to the soil.

Phosphate broadcast after removal of first-crop alfalfa was effective in supplying phosphorus to the plant (1951). In 1952, in a similar experiment, superphosphate at 40, 80, and 120 pounds of P_2O_5 per acre was broadcast after the removal of first crop alfalfa. Approximately one-half of the phosphorus in mature alfalfa came from the fertilizer. The addition of potassium increased the uptake of phosphorus. The phosphorus content of alfalfa increased progressively with increased rates of phosphate application.

Cordukes, W. E., MacLean, A. J., and Bishop, R. F. THE COMPARATIVE EFFECTS OF MANURE AND COMMERCIAL FERTILIZER IN A LONG-TERM SOIL FERTILITY EXPERIMENT. Canad. Jour. Agr. Sci. 35: 229-237. 1955.

In a long-term field experiment in Canada, 15 tons of manure per acre applied for each cycle of a rotation of mangels, oats, clover, and timothy was effective in maintaining the yield of each of the crops during 40 years. With application of commercial fertilizer containing the equivalent of 64 lbs. (N), 48 lbs. (P_2O_5) and 37.5 lbs. (K_2O) per acre for each cycle of the rotation, the yield of mangels was maintained, the yield of oats was increased, but there was some decline in the yield of hay as the experiment was continued. Where a combination of manure and fertilizer was applied at reduced rates, there were trends for the yields of mangels and oats to increase and for the yield of hay to decrease with time. Without manure or fertilizer, the yields of all crops declined markedly with continuation of the experiment.

Dean, L. A. YIELD-OF-PHOSPHORUS CURVES. Soil Sci. Soc. Amer. Proc. 18: 462-466. 1954.

This paper embraces a study of the curves relating the total phosphorus absorption by plants with the fertilizer phosphorus additions (yield-of-phosphorus curves) and may be summarized as follows: For applications up to 160 pounds of P_2O_5 per acre mixed throughout the soil, the "normal" yield-of-phosphorus curve was an ascending straight line. Extrapolation of the yield-of-phosphorus curves to the point of intersection with the X axis gave a measure of the available soil phosphorus which approximated the A value. Estimates obtained by extrapolation of yield curves gave values about half as large. The slope of the yield-of-phosphorus curves is to a degree influenced by the phosphate-fixation processes.

Fitts, J. W., Bartholomew, W. V., and Heidel, H. PREDICTING NITROGEN FERTILIZER NEEDS OF IOWA SOILS: I. EVALUATION AND CONTROL OF FACTORS IN NITRATE PRODUCTION AND ANALYSIS. Soil Sci. Soc. Amer. Proc. 19: 69-73. 1955.

To adapt nitrate production for use in soil-testing laboratories for evaluating the capacity of soils to supply nitrogen to crops, a procedure was evolved which is accurate yet inexpensive and can be determined on a mass-production basis. The influence of environmental factors on nitrate production during incubation in the laboratory was studied along with methods of sample manipulation to increase the time efficiency in analysis.

Ten-gram samples of soil were found to give accuracy comparable to 25- and 100-gram samples provided moisture was controlled during incubation. Moisture losses can be closely controlled without creating suboptimum aeration by stoppering the sample containers with one-hold rubber stoppers and incubating in an atmosphere nearly saturated with water. High humidity was maintained by placing flat open ceramic vessels filled with water in the top and bottom of the incubator.

Nitrate production took place over a fairly wide range of soil moisture. Adjustment of moisture by tension methods proved more satisfactory than by the addition of constant quantities per sample. Of the tensions studied, 100 cm. water provided the most optimum moisture for the production of nitrates. This resulted in 25- to 35-percent moisture, depending on the texture of the samples and was a little above the field capacity.

Forsee, W. T., Jr. CONDITIONS AFFECTING THE AVAILABILITY OF RESIDUAL AND APPLIED MANGANESE IN THE ORGANIC SOILS OF THE FLORIDA EVERGLADES. Soil Sci. Soc. Amer. Proc. 18: 475-478. 1954.

Manganese-deficiency symptoms are quite prevalent in plants growing on the organic soils of the Florida Everglades. These experiments were conducted to determine the effect of soil pH, microbiological populations and sources of applied manganese on the availability of this essential element in the soil. Greenhouse and field experiments were carried out and the results measured in terms of plant growth, yield, soil analyses, and plant analyses. The organic soils show progressively decreasing amounts of available manganese as their pH values increase to 6.0, and beyond this pH they may not have ability to supply the plant requirements either from residual or applied manganese. Soil sterilization may release large amounts of residual manganese and promote normal growth of plants. Lowering of the soil pH to values slightly below 6.0 will render the fixed manganese more available and will also reduce fixation of applied manganese. Sulfur applications to lower the soil pH have been used with considerable success in commercial plantings, and have resulted in very substantial yield increases, especially with leafy vegetables.

Forsee, W. T., Jr., Erwin, T. C., and Kretschmer, A. E., Jr. COPPER OXIDE AS A SOURCE OF FERTILIZER COPPER FOR PLANTS GROWING ON EVERGLADES ORGANIC SOILS. Fla. Agr. Expt. Sta. Bul. 552. 1954.

These experiments indicate that finely ground copper oxide as a soil corrective for copper deficiencies in crops growing on Everglades organic soils is as efficient as copper sulfate when applied on the basis of equivalent amounts of elemental copper. Furthermore, both forms may be applied with equal effect, either as separate applications or mixed in the fertilizer. Maximum growth and yield responses with the indicator plants used in these experiments under both greenhouse and field conditions were obtained with soil applications of the copper compounds equivalent to 12 pounds per acre of elemental copper.

Fox, E. J., Hardesty, J. O., and Kumagai, R. INFLUENCE OF SURFACE ACTIVE AGENTS IN SUPERPHOSPHATE, MIXED FERTILIZER PRODUCTION. Farm Chemicals, 1954.

Plant-scale tests on the use of 0.5 pound of surface active agent per ton of superphosphate in fertilizer preparations show that the anionic type added during the acidulation of double-floated Florida land pebble phosphate rock reduced the rate and extent of the reaction between the rock and acid over a period of 6 weeks' storage in the curing pile, flattened the charge in the mixing pan and den, and thereby produced a harder and denser superphosphate.

These effects are attributable to surface coating of the rock particles with the acid-incompatible organic anion which separated as a tar-like substance upon addition of the surfactant to the acid. A similar coating on the surface of the superphosphate particles reduced bag-set in incompletely cured mixed fertilizer prepared from the surfactant-treated superphosphate.

The acid-compatible nonionic type of surfactant promoted the rock-acid reaction, increased the bloat in the mixing pan and den and thereby produced a less dense superphosphate, and seemingly favored the retention of ammonia during its ammoniation in mixed fertilizer preparation.

Fox, E. J., and Jackson, W. A. SORPTION OF SURFACE ACTIVE AGENTS FROM AQUEOUS SOLUTION BY PHOSPHATE ROCK. Agr. and Food Chem. 3: 38-42. 1955.

The adsorption of surface active agents from aqueous solutions by phosphate-rock suspensions was investigated as a possible clue to previously reported differences between the behaviors of nonfloated and double-floated phosphate rocks during acidulation. Changes in surfactant concentration as measured by differences in relative surface tensions of the solutions before and after contact with the rock indicate that the anionic, nonionic, and cationic types of surfactants are adsorbed on the surface of rock particles in varying degrees depending on the type and molecular complexity of the surfactant, the particle size and the degree of surface saturation of the rock, and on the previous treatment of the latter with one or more flotation reagents. The presence of the cationic reagent used in the flotation process doubtlessly explains the enchanced reaction rates observed in the acidulation of double-floated rock.

Hanway, J., and Dumenil, L. PREDICTING NITROGEN FERTILIZER NEEDS OF IOWA SOILS: III. USE OF NITRATE PRODUCTION TOGETHER WITH OTHER INFORMATION AS A BASIS FOR MAKING NITROGEN FERTILIZER RECOMMENDATION FOR CORN IN IOWA. Soil Sci. Soc. Amer. Proc. 19: 77-80. 1955.

A large number of field-fertilizer experiments have provided a general basis for predicting nitrogen fertilizer needs of crops in Iowa. Nitrate production now provides additional information making possible accurate prediction of nitrogen needs. The relation between nitrate production and the yield increases obtained from different rates of application of nitrogen fertilizer on corn (limited to corn which does not follow a leguminous meadow) is presented and discussed. This relation is summarized by the equation: $\log Y = \log [104(1- 10^{-0.003525x})]-0.0098b_1$ where Y =bushels per acre yield increase to be expected from an application of x pounds of nitrogen per acre on a soil with a nitrate nitrogen. The most profitable rate of application of nitrogen fertilizer is given by the equation: $x = -21 + 284 \log K - 2.8b_1$ where x represents the most profitable rate of nitrogen to apply to a soil with a nitrate production of b_1 p.p.m. when K = the price of corn per bushel divided by the price of nitrogen per pound. The method used here appears to hold much promise for the calibration of other soil tests. Various factors which may influence the interpretation of the test results are discussed.

Henderson, D. W., Binachi, W. C., and Doneen, L. D. AMMONIA LOSS FROM SPRINKLER JETS. Agr. Engin. 36: 398-399. 1955.

Some of the factors affecting losses of ammoniacal fertilizers from sprinkler jets were investigated. The principal consideration is the pH of the fertilizer solution, which depends on characteristics of both the irrigation water and the fertilizer materials.

Field application of ammonia fertilizers results in losses other than those from the jet. If the pH of the fertilizer solution being applied is kept as near neutral as practicable, it is probable that all losses would be reduced to a minimum.

Hill, W. L., Caro, J. H., and Wieczorek, G. A. PHOSPHATE EVALUATION, SURFACE AREA ON NATURAL AND PROCESSED PHOSPHATES. Agr. and Food Chem. 2: 1273-1277. 1954.

Reliable information was needed on the ranges of surface area likely to be encountered in bone products, dicalcium phosphate, basic calcium phosphates, and phosphate rock. Basic calcium phosphate and steamed bone surfaces (4.5 to 142 square meters per gram) were of the same order as clays. Dicalcium phosphate and phosphate rock ranged from 0.6 to 37 square meters per gram. The influence of particle size (sieve range) on measured surface was practically negligible for steamed bone. The surface of some varieties of phosphate rock increased very little with finer grinding, whereas that of others increased markedly. The elementary grain size of phosphate rocks estimated from surface measurements agree in order of magnitude with figures obtained by other methods (10^{-2} to >1 micron). The results provide a basis for studies on the surface chemistry of water-insoluble phosphates. Elementary grain size appears to be a reliable index of chemical reactivity and agronomic merit of phosphate rock varieties (usual grinds) that carry the normal complement of fluorine.

Jackman, R. H. ORGANIC PHOSPHORUS IN NEW ZEALAND SOILS UNDER PASTURE: II. RELATION BETWEEN ORGANIC PHOSPHORUS CONTENT AND SOME SOIL CHARACTERISTICS. Soil Sci. 79: 293-299. 1955.

A study was made of the relation between soil organic phosphorus content and total phosphorus content, organic carbon content, soil pH, inorganic-phosphate-fixing capacity as determined by an empirical method, and soil group in soils under pasture from 18 field trials representing 17 soil tests.

Organic phosphorus was positively correlated with total phosphorus content and was significantly greater in yellow-brown loams than in podzolic soils from sedimentary rocks and in soils of a mixed group, the one exception being an organic soil.

Organic phosphorus was positively related to organic carbon content and inorganic-phosphorus-fixing capacity, and the last two characteristics were also positively related. It is suggested, on the basis of the very high levels of organic phosphorus and carbon and phosphate-fixing capacity in the yellow-brown loams, that allophane may be the agent responsible for the stabilization of carbon and organic phosphorus in the yellow-brown loams and pumice soils. Other clay minerals may play a similar role, but to a smaller extent. Reduced effective microbial activity may also play a part. No significant relation could be found between organic phosphorus content and soil pH.

Jones, U. S., and Edwards, W. D. LIMESTONE, DOLOMITE, AND CALCIUM SILICATE SLAG FOR WHITE CLOVER PASTURES ON RED AND YELLOW SOILS. Soil Sci. Soc. Amer. Proc. 18: 412-417. 1954.

An experiment has been conducted on 5 red and yellow podzolic soils since 1949 to study the effects of 3 kinds and 4 levels of lime on whiteclover seed and forage yields. The exchangeable calcium in the soil and soil pH as well as percentage of protein and calcium in the clover forage were used as measures of treatment effect. Other experiments were carried on to determine the availability of phosphorus in calcium silicate slag as measured by whiteclover forage yields.

The design of the experiment was a split plot in which the whole plots were 3 kinds of lime, viz., calcium silicate, calcitic and dolomitic limestone, and the subplots were rates of lime, viz., none, 1,000, 2,500, 4,000, and 6,000 pounds per acre. Lime applied at 1,000, 2,500, and 4,000 pounds per acre progressively increased clover forage and seed yields on Prentiss fine sandy loam, Bowie fine sandy loam, and Stough very fine sandy loam for more than 3 years. On Loring and Richland silt loams, rates of lime up to 6,000 pounds per acre produced progressive increases in forage and seed production. Lime added at 1,000 to 4,000 pounds per acre produced an annual increase of protein in the clover forage from 36 to 190 pounds per acre. The calcium in the plant material was also increased by additional increments of lime. There was a progressive increase in soil pH and exchangeable calcium at all locations as the rates of lime increased. There was little difference among the 3 liming materials for increasing the pH and base content of the soil. Likewise, there was little difference among the 3 liming materials for increasing the forage and seed yields. Mean forage yields at all experimental sites showed a similar response to phosphorus contained in 4,000 pounds calcium silicate slag as to the phosphorus in 250 pounds of superphosphate applied with 4,000 pounds of calcitic limestone. The calcium silicate contained 1.3 percent P_2O_5.

Kretschmer, A. E., Jr., and Forsee, W. T., Jr. THE USE AND EFFECTIVENESS OF VARIOUS COPPER BEARING MATERIALS FOR APPLICATION TO EVERGLADES ORGANIC SOILS. Soil Sci. Soc. Amer. Proc. 18: 471-474. 1954.

One of the classic examples of plant response to Cu is in the vast area of organic soils of Peninsular Florida. Most crops failed to grow on these soils until the middle 1920's when the need for Cu was first demonstrated. Tremendous growth response of various leafy vegetables, cruciferous plants, root crops, eggplant, tomatoes, and certain forage crops have been obtained with initial applications of 50 pounds an acre of copper sulfate. In recent years it has been found that copper oxide is at least as effective as copper sulfate in supplying sufficient copper for maximum plant growth. Results of greenhouse tests indicated that either source is as effective when added to the soil in mixed fertilizer as when added separately. Further work showed that plant response to Cu on virgin peaty muck soil was the same whether 12 or 24 pounds of Cu per acre was applied.

Kumagai, R., and Hardesty, J. O. EFFECTS OF SURFACE ACTIVE AGENTS ON PROPERTIES OF SUPERPHOSPHATES AND MIXED FERTILIZERS. Agr. and Food Chem. 3: 34-38. 1955.

Seven different surfactants were selected as representative of a large number of such agents currently marketed for use in mixed fertilizers. A study has been made of the effects of these surfactants on densities and ammonia-absorption efficiencies of ordinary and triple superphosphates and on caking tendencies of mixed fertilizers.

Nonionic surfactants added during acidulation of rock in amounts equivalent to 0.75 pound of active ingredient per ton of superphosphate decreased the bulk densities of 20-40 mesh size-fractions of cured superphosphates as much as 13.5 percent, whereas anionic surfactants increased the bulk densities as much as 13.2 percent.

Ammonia-absorption efficiencies of superphosphates prepared with surfactants added during acidulation were 1 to 9 percent higher than those of the corresponding reference superphosphates. No correlation was found between absorption efficiencies and bulk densities.

Lawton, K., Tesar, M. B., and Kawin, B. EFFECT OF RATE AND PLACEMENT OF SUPERPHOSPHATE ON THE YIELD AND PHOSPHORUS ABSORPTION OF LEGUME HAY. Soil Sci. Soc. Amer. Proc. 18: 428-432. 1954.

A study was undertaken to determine the effect of superphosphate topdressing on the yield and phosphorus content of legume and legume-grass hay. Radioactive superphosphate containing 20 percent P_2O_5 was broadcast in the early spring on established meadows at five locations in central Michigan.

A significant yield response of first cutting hay was obtained on all fields as a result of topdressed applications of 80 and 120 pounds of P_2O_5 per acre. The hay which was thus treated contained appreciably more phosphorus than did that which was grown on untreated plots or where only 40 pounds of P_2O_5 was applied.

The absorption of fertilizer phosphorus was low in hay grown on two soils and relatively high in hay from the remaining locations. As the rate of broadcast superphosphate increased, the percentage of plant phosphorus derived from fertilizer in forage plants also increased. The recovery of fertilizer phosphorus by first-cutting hay from two locations was low, but was as high as 15 percent in hay from the other areas. As the rate of broadcast superphosphate increased, the percentage of recovery of applied phosphorus decreased.

Luginbill, P., Jr., and McNeal, F. H. EFFECT OF FERTILIZERS ON THE RESISTANCE TO CERTAIN WINTER AND SPRING WHEAT VARIETIES TO THE WHEAT STEM SAWFLY. Agron. Jour. 46: 570-573. 1954.

Field tests were conducted on Rescue and Thatcher spring wheat and on Yogo winter wheat in a sawfly-infested area near Choteau, Mont., to determine what effect certain fertilizers have on the amount of sawfly damage. Phosphorus and nitrogen were applied at different rates and mixtures and at different dates to plots of Rescue and Thatcher. Potassium, phosphorus, and nitrogen were used in various mixtures on Yogo at the time of seeding.

Phosphorus applied alone or mixed with nitrogen at planting time was closely associated with an increase in the amount of sawfly cutting on both winter and spring wheats. The increase in cutting on winter wheat appeared to be associated with an increase in sawfly infestation and growth response. Potassium applied together with nitrogen and phosphorus had a tendency to decrease the amount of sawfly cutting on winter wheat, whereas nitrogen alone had little effect on sawfly cutting, infestation, or growth response. Potassium applied alone had little effect on the amount of sawfly cutting, or on the number of culms produced, although it did produce some increase in the number of stems infested and in growth response. When fertilizers were applied other than at the time of seeding on spring wheat, there was no significant difference in amount of sawfly cutting.

The data presented indicate that some physiological or structural change occurred in the varieties tested, which made them generally more susceptible to sawfly infestation and cutting when certain fertilizers were applied.

Lunt, H. A., THE USE OF WOODCHIPS AND OTHER WOOD FRAGMENTS AS SOIL AMENDMENTS. Conn. Agr. Expt. Sta. Bul. 593. 1955.

Studies were conducted for more than 5 years to determine the effectiveness of woodchips (and sawdust) for soil improvement. Mostly the chips were applied only once and worked into the soil, with and without extra nitrogen. Crop yields or plant growth was measured and various tests made on the soils. The work was done in greenhouse pots, in outdoor soil frames, and on field plots.

Woodchips (or sawdust): (1) had no appreciable effect on soil acidity nor were they toxic to plants aside from the temporary nitrogen deficiency. (2) Chips had a modest but generally favorable effect on soil structure, organic-matter content, and associated soil properties. (3) When fresh, chips almost invariably reduced first crop growth and were not consistent in their effect on succeeding crops. (4) When supplemented with sufficient nitrogen or when composted before applying, chips did not decrease first crop yields, and they generally increased yields of succeeding crops. (5) Chips are probably more effective on sandy soils than on loams, although very coarse-textured soils may become excessively loose and open the first year or two, unless the chips are first composted. (6) Birch chips decomposted more rapidly than either oak or pine and would require the most nitrogen to prevent deficiencies. Pine decomposition was slowest of the three and required the least amount of nitrogen. In general, pine chips were more effective than oak or birch in improving the soil.

McLean, E. O., and Hoelscher, J. E. FACTORS AFFECTING YIELDS AND UPTAKE OF PHOSPHORUS BY DIFFERENT CROPS: I. PREVIOUS APPLICATIONS TO THE SOIL OF ROCK PHOSPHATE AND SUPERPHOSPHATE. Soil Sci. 78: 453-462. 1954.

The residual effects of rock phosphate and superphosphate applied alone and in complete treatments to an upland soil of the Ozark Region for 32 years were assayed with buckwheat, oats, and alfalfa by use of radioactive superphosphate.

Soil from the field-check plot when treated with radioactive superphosphate brought about greater crop yields and P_2O_5 uptake than did the untreated soil. Buckwheat yielded much higher and took up much more P_2O_5 than did oats and alfalfa on all pretreated soils regardless of greenhouse treatment.

Soil from plots pretreated with phosphates when treated with tagged superphosphate brought about greater yields of oats and, in certain instances, of buckwheat than did the untreated. The greenhouse treatment nowhere increased the yield of alfalfa significantly where a pretreatment of phosphate had been applied in the field. In most instances the yields were significantly depressed. Total uptake of P_2O_5 from all phosphate-pretreated soils was not consistently increased by greenhouse treatment.

Buckwheat and oats took similar proportions of their phosphate from the fertilizer source. Alfalfa took only about half as large a proportion of its phosphate from the fertilizer as did buckwheat and oats. This necessarily meant that alfalfa took more of its phosphate from the soil source.

Buckwheat recovered about 40 percent of the fertilizer phosphorus applied to the soil with but little variation with pretreatment. Oats recovered on the average about 12 percent and alfalfa only about 4 percent of that applied.

Northeastern Soil Research Commission (C. L. W. Swanson, Chairman). THE CHANGING FERTILITY OF NEW ENGLAND SOILS. U. S. Dept. Agr. Agr. Inf. Bul. 133. 1954.

Although a balance sheet of input and outgo of plant nutrients in the soil is impossible to compile from present knowledge, evaluation of available evidence, such as manure from shipped-in feeds, biological fixation, rainfall, leaching, crop removal, fertilizers applied, and other sources, indicates that for many farms more N is being applied to the agricultural soils than is being removed.

About 2-1/2 times as much P_2O_5 is being applied annually to New England soils as is being removed. About 60 percent of the K apparently removed is being returned. These are averages for the region and cannot be applied to any given farm or field.

In New England, about 4-1/2 times as much CaO and more than twice as much MgO are applied to cropland as are removed in harvested crops, but the percentage replacements of these nutrients are only 47 and 34 percent, respectively. This may be explained in part by the large quantities in drainage waters of CaO and MgO derived from calcium- and magnesium-bearing minerals in soils and rocks.

The removal of N, P_2O_5, and K_2O for the years 1942 and 1948 in crops harvested was in the ratio of 1.00-0.28-1.16.

Potato yields in Maine are now 4-1/2 times as large as they were 80 years ago. This enormous increase is explained partly by shifts to soils adapted to the crop, increased fertilizer use, and new pesticide controls.

Paschal, J. L., and Evans, C. E. ECONOMIC INTERPRETATIONS OF YIELD DATA FROM A NITROGEN RATE EXPERIMENT WITH IRRIGATED GRAIN SORGHUM. Soil Sci. Soc. Amer. Proc. 18: 454-458. 1954.

Yield data from a nitrogen rate experiment with grain sorghum on newly developed irrigated land at Tucumcari, N. Mex., were analyzed to ascertain the most profitable rate of nitrogen application for each of four treatment combinations of moisture and plant spacing. The principle of diminishing yield increments is used in calculating the most profitable rate.

With the price of sorghum at $1.12 a bushel and the price of nitrogen at $0.15 a pound, the most profitable rate of nitrogen application ranges from 75 to 152 pounds per acre. The most profitable rate is highest with high moisture (8 irrigations) and thick spacing (43,560 plants per acre) and lowest with low moisture (5 irrigations) and thin spacing (20,028 plants per acre). Moisture level influences the most profitable rate of nitrogen application more than does plant population. When nitrogen is applied at its most profitable rate, the return to nitrogen above its cost with high moisture is $33 for thick and $11 per acre for thin spacing. With low moisture, the return is $15 and $19 per acre for thick and thin spacing, respectively.

Patrick, W. H., Jr., and Sturgis, M. B. CONCENTRATION AND MOVEMENT OF OXYGEN AS RELATED TO ABSORPTION OF AMMONIUM AND NITRATE NITROGEN BY RICE. Soil Sci. Soc. Amer. Proc. 19: 59-62. 1955.

A study has been made to determine the effects of oxygen on the growth of rice and the absorption of nitrate and ammonium nitrogen by rice. Bubbling free oxygen through the soil and floodwater caused an increase in the growth of rice. The oxygen added to the cultures followed a channel up through the soil and thus was not distributed throughout the soil. No oxygen was present in the soil 1 cm. below the soil-water interface. The increased growth of rice obtained from the application of oxygen was restricted to its effect at the soil surface. The rate of reduction of oxygen by a soil was increased by the submergence of the soil and was further increased by the addition of organic matter. Ammonium nitrogen produced a greater growth of rice than did nitrate nitrogen. A greater amount of nitrogen was absorbed by the rice from an ammonium source than from a nitrate source of nitrogen. No specific interaction between the oxygen treatments and the intake of nitrate or ammonium nitrogen by rice was measurable. This was probably because the diffusion of oxygen from leaves and stems to roots was not controlled.

Pelton, W. L., and Webber, L. R. THE EFFECTS OF IRRIGATION AND CHEMICAL FERTILIZATION ON THE YIELD AND PROTEIN CONTENT OF A PASTURE MIXTURE. Canad. Jour. Agr. Sci. 35: 1-10. 1955.

One year's data from irrigating an orchard grass-ladino clover mixture in the Guelph area indicate that supplemental water and chemical fertilizer are important in maintaining pasture yields. The last two clippings, 4 and 5, the only ones to be irrigated, gave highly significant increases in dry-matter and protein production. Fertilizer increased total production of dry matter and protein and significantly added to the protein content of grass. At each level of fertility, irrigation increased the legume content of the forage whereas fertilizer increased the proportion of grass in the mixture at each level of watering.

Pesek, J. THE ADSORPTION OF PHOSPHORUS FROM PHOSPHATE FERTILIZERS APPLIED TO ESTABLISHED MEADOWS. III. EFFECT OF PHOSPHORUS SOURCE AND PLACEMENT AND OF MEADOW COMPOSITON. Soil Sci. Soc. Amer. Proc. 19: 63-66. 1955.

Three experiments were conducted to determine the absorption of phosphorus from concentrated superphosphate and calcium metaphosphate when applied to established meadows. They were located on Ida silt loam, a loess derived calcareous (pH 7.8) soil in western Iowa; Seymour silt loam, a loess derived acid (pH 5.8) soil in southern Iowa; and Floyd loam, a glaciated acid (pH 5.6) soil in northeastern Iowa. The differential phosphate treatments supplied 40 pounds of P_2O_5 per acre as concentrated superphosphate and <10 and <40 mesh calcium metaphosphate. Each phosphate source was applied broadcast or drilled in rows 7 inches apart and about an inch deep to compare placement.

Either broadcasting or drilling the phosphate fertilizers studied is an effective means of supplying additional phosphorus to established meadows; however, the drilling operation appears to decrease the forage yields slightly at all three locations. In addition, the plant-absorption data for phosphorus shows that broadcasting was more effective than drilling as a method of applying calcium metaphosphate.

Porter, K. B. GRAIN SORGHUM FERTILIZER TRIAL, AMARILLO EXPERIMENT STATION, 1954. Texas Agr. Expt. Sta. Prog. Rpt. 1745. 1955.

Nitrogen alone at 80 pounds per acre gave the most economical increase in yield during these trials.

Prince, A. B. YIELD AND CHEMICAL COMPOSITION OF ANNUAL RYEGRASS AND CRIMSON CLOVER AS AFFECTED BY NITROGEN AND POTASSIUM FERTILIZATION. Soil Sci. 78: 445-452. 1954.

The effects of N and K fertilization on the yield and mineral composition of annual ryegrass and crimson-clover forage grown in the field on Cecil sandy loam were determined. An increase in the number of topdressings of N increased the yield and the N, P, and K content of the forage and indirectly decreased the Ca and Mg content. Increasing the rate of K application from 40 to 120 pounds per acre had no apparent effect on the yield or on the N and P content of the forage but did increase the K content. This increase in K caused a significant decrease in the Ca and Mg content.

Soil moisture, temperature, nature of the two plant species, and maturity of the forage as well as fertilization had marked effects on the mineral content of the forage.

Robertson, L. S., Guttay, J. R., and Hansen, C. M. SUPPLEMENTAL NITROGEN FOR OATS. Mich. Agr. Expt. Sta. Quart. Bul. 37: 420-424. 1955.

Oat yields were increased in average of 8 bushels per acre from 1951 to 1953 in crop-rotation experiments by topdressing with 20 pounds of nitrogen.

In another experiment, nitrogen topdressing increased oat yields 45 bushels per acre where ample potassium and phosphorus were available. Nitrogen failed to affect changes in yield where these nutrients were not available in sufficient quantities.

Samuels, G., and Laundrau, P., Jr. THE INFLUENCE OF POTASSIUM ON THE YIELD AND SUCROSE CONTENT OF SUGARCANE. Soil Sci. Soc. Amer. Proc. 19: 66-69. 1955.

The results of over 200 field experiments with potash fertilizers on sugarcane, conducted by the Agricultural Experiment Station of the University of Puerto Rico over a wide range of cane varieties and soils of Puerto Rico, were analyzed with respect to the influence of the potash on cane yields and sucrose content. The results indicated that potash increased yields mainly on the red and yellow podzolic soils of the humid area and in a planosol of the semiarid area. The irrigated cane areas showed slight if any response to potash. The use of potash increased sucrose concentrations in the cane only if cane yields were also increased. Increases of 10 percent or more in cane tonnage were needed for increases in sucrose. Potassium fertilizer did significantly influence sucrose concentration, but this was accomplished mainly by raising the polarization value of the cane juice. Percent Brix and extraction were not appreciably influenced.

The use of foliar diagnosis proved to be of great value in determining when to apply potash fertilizers to cane. Leaf values of 2.00 percent or more on a dry-weight basis indicated no expected potash responses for all soils and cane varieties in Puerto Rico. In humid areas, leaf values below 1.80 percent indicated that a response to potash fertilizers could be expected.

Seatz, L. F., Tisdale, S. L., and Winters, E. CROP RESPONSE TO FUSED TRICALCIUM PHOSPHATE. Agron. Jour. 46: 574-579. 1954.

Results are summarized from 425 experiments in which concentrated superphosphate and various size fractions of fused tricalcium phosphate are compared as a source of phosphorus on 13 crop classes. The following conclusions seem warranted: FTP is not a satisfactory source of phosphorus on alkaline soils for any crop tested.

On acid soils the crop grown had a greater influence on the response obtained from FTP than any other factor studied. FTP proved to be a satisfactory source of phosphorus for soybeans, for beans, alfalfa and sericea, pasture crops, small grains for grain, red clover, vetch and crimson clover, and small grains for forage. Corn, soybeans for hay, cotton, and vegetable crops did not respond as satisfactorily to FTP as to CSP. Sudan grass and lespedeza did not respond differently to FTP than to CSP at the 5-percent level of significance, but the small number of comparisons make these results less precise.

Finely ground FTP gave better yield responses than did coarser material. However, these differences were not significant at the 5-percent level. Effectiveness of FTP compared with CSP was slightly less on limed than on unlimed soils. The effectiveness of FTP was not consistently different on soils highly deficient in available phosphorus than on all soils for which a yield response to phosphorus fertilization was obtained. Residual effects of FTP are not consistently different from those of CSP.

Sheard, R. W., and Caldwell, A. G. THE USE OF ANION-EXCHANGE RESINS IN PHOSPHORUS FERTILITY STUDIES. Canad. Jour. Agr. Sci. 35: 36-41. 1955.

A phosphated anion-exchange resin, IR-4B, was considered to be a suitable substitute for monocalcium phosphate as a phosphorus standard for the determination of "A" values. Complete adsorption of phosphorus by the resin, Dowex 2, from aqueous solutions containing up to two p.p.m. phosphorus was obtained, but only 95- to 99-percent recovery was possible by the procedure adopted. "A" values and soil phosphorus released to Dowex 2 in 2 hours for 24 Ontario soils were significantly correlated ($r = 0.87$). A discussion of techniques involving anion-exchange resins as compared to methods requiring P^{32} is given, and the anion-exchange technique is considered to have certain advantages in some soil-phosphorus studies.

Stanford, G., and Hanway, J. PREDICTING NITROGEN FERTILIZER NEEDS OF IOWA SOILS: II. A SIMPLIFIED TECHNIQUE FOR DETERMINING RELATIVE NITRATE PRODUCTION IN SOILS. Soil Sci. Soc. Amer. Proc. 19: 74-77. 1955.

A technique for determining the amount of nitrate nitrogen released in soils upon incubation has been developed and adapted for routine use in the Iowa State College Soil Testing Laboratory. A 10-gram sample of soil, mixed with vermiculite, is placed in a filter tube and leached free of nitrate with distilled water. Suction is then applied to remove excess water. In this way, nitrate removal, as well as adjustment of moisture content to near optimum for microbial activity, is effectively accomplished with soils possessing a wide range in texture and content of organic matter. After incubation for 2 weeks in a humid chamber at 35° C., the sample is again leached, and nitrate produced during the period is determined by the phenoldisulphonic acid method. A unique feature of the method is that only one nitrate analysis is required in determining the quantity of nitrate released on incubation. Nitrate initially leached from the sample may be discarded. The mixing of vermiculite with the soil facilitates moisture control due to the high water-holding capacity of this material. Moreover, it permits free exchange of air in the sample during incubation, even though suction is applied in the initial adjustment of moisture content prior to incubation.

Stanford, G., Hanway, J., and Meldrum, H. R. EFFECTIVENESS AND RECOVERY OF INITIAL AND SUBSEQUENT FERTILIZER APPLICATIONS ON OATS AND THE SUCCEEDING MEADOWS. Agron. Jour. 47: 25-31. 1955.

In 1950, two 2x2x3 NPK factorial experiments were established on oat-meadow seedings in north-eastern Iowa. Soils were Carrington and Fayette fine sandy loams. On the first year of meadow in 1951 a 2 x 2 PK factorial was superimposed on each experiment by splitting the main plots. This resulted in 48 distinct fertilizer treatments, the effects of which were evaluated on the basis of hay yields, botanical composition, and chemical composition of the forage. Results presented and discussed in this paper have been confined largely to those which were of major significance. Certain conclusions may be summarized briefly as follows:

(1) On both soils, oats responded markedly to nitrogen, phosphorus, and potassium fertilization. Considering meadow yields, however, only potassium appeared to be markedly deficient on the Fayette soil, while phosphorus appeared to be the chief limiting factor on the Carrington soil, although in the latter experiment a deficiency of potassium also was evident.

(2) A nitrogen-potassium relation was illustrated in both experiments on the meadow. Neither of these nutrients gave maximum benefits unless the other also was supplied. In fact, a slight depressive effect of nitrogen on hay yields was evident in the absence of potassium fertilizer, whereas significant increases occurred in the presence of additional potassium.

(3) In the red clover-timothy association, timothy contained the higher percentage of potassium. With increasing rates of phosphorus fertilizer, the potassium content of red clover declined, while that of timothy remained at the higher level or slightly increased.

Thompson, L. F., and Pratt, P. F. SOLUBILITY OF PHOSPHORUS IN CHEMICAL EXTRACTANTS AS INDEXES TO AVAILABLE PHOSPHORUS IN OHIO SOILS. Soil Sci. Soc. Amer. Proc. 18: 467-470. 1954.

Eighteen samples of soils were subjected to greenhouse cropping with alfalfa and corn and to various extractant solutions for measurements of soluble P. The

P removed from the soils by alfalfa and the A values calculated from the uptake by corn of radioactivity tagged superphosphate were used as a measure of plant-available P. The accuracy of estimation of available P by the solubility data was obtained by comparing the P solubility in the various extractant solutions against the plant-available P. The Bray No. 1 solution (0.03 N NH_4F-0.025 N HCl) and the 0.5 M $NaHCO_3$ solution extracted amounts of P that were accurate estimates of plant-available P. The Bray No. 2 solution (0.03 N NH_4F-0.1 N HCl), 0.002 N H_2SO_4, and citric acid extracted amounts of P that when plotted against the plant data gave a distinctly different relationship for young soils formed from high-lime late Wisconsin till than for older soils formed from more acid parent materials.

Wear, J. I., and Wilson, C. M. BORON MATERIALS OF LOW SOLUBILITY AND THEIR USE FOR PLANT GROWTH. Soil Sci. Soc. Amer. Proc. 18: 425-428. 1954.

Three sources of boron including high-grade fertilizer borate, colemanite, and howlite were compared as to their water-soluble boron contents, effect on plant growth, and movement within the soil profile. Based on mill-run samples, the water-soluble boron in fertilizer borate was 5 times greater than in colemanite and 25 times greater than in howlite.

Particle size had only a slight effect on the water-soluble boron recovered from fertilizer borate, but for colemanite and howlite the amount of water-soluble boron recovered was 6 to 8 times greater for finer than 80-mesh material as compared to coarser than 10-mesh material. This indicates the importance of particle size in controlling the rate of solubility of the more slowly soluble sources of boron.

Results of the field-leaching study on Norfolk loamy sand indicate that high-grade fertilizer borate leached out of the topsoil very rapidly and collected in the lower zones of 8 to 16 and 16 to 24 inches. Twelve months later most of the water-soluble boron had been leached past the 2-foot depth. Howlite leached out of the topsoil slowly; the concentrations of water-soluble boron remained fairly constant for the 6 and 12 months. Colemanite was found to be intermediate between the highly soluble sodium borate and the less soluble borosilicate from the standpoint of loss by leaching.

Webb, J. R., and Pesek, J. T., Jr. EVALUATION OF RESIDUAL SOIL PHOSPHORUS IN PERMANENT FERTILITY PLOTS. Soil Sci. Soc. Amer. Proc. 18: 449-453. 1954.

Areas of 4 longtime fertility experiments that were planted to oats in 1952 were used to study the effect of different past treatments upon the level of available soil phosphorus.

Phosphorus A values, as derived by Fried and Dean, were compared with the Bray soil phosphorus test and with crop yields as a means of evaluating the soil-phosphorus level. The A values appeared to be very satisfactory and correlated significantly with soil-test phosphorus values and with oat yields. At 3 of the 4 locations, a higher degree of correlation existed between A values and yields than between soil-test phosphorus and yields. Phosphorus A values, determined from plant samples harvested at maturity, were higher than those determined from an earlier sampling but did not correlate any better with yields or soil-test phosphorus. The 1952 results from the longtime experimental treatments indicated that ordinary superphosphate, concentrated superphosphate, and calcium metaphosphate applied at equal rates of P_2O_5 for years appear to have an equal effect upon the residual level of available soil phosphorus and upon the yield of oats. Fused tricalcium phosphate compared favorably with these materials on an acid soil but was less effective as a phosphate source on a calcareous soil. Rock phosphate applied at equal or higher rates of P_2O_5 was a less effective source at all locations and by all three standards of comparison.

Webb, J. R., Ohlrogge, A. J., and Barber, S. A. THE EFFECT OF MAGNESIUM UPON THE GROWTH AND THE PHOSPHORUS CONTENT OF SOYBEAN PLANTS. Soil Sci. Soc. Amer. Proc. 18: 458-462. 1954.

An investigation was made of the effect of magnesium upon the growth, the phosphorus absorption and translocation, and the cation content of soybean plants. The plants were grown in sand culture in the greenhouse, and the main treatment consisted of removing magnesium from the nutrient medium for various periods during the life cycle of the plants.

The removal of magnesium from the nutrient medium for any of seven different periods of 21 to 121 days during the life of soybean plants reduced growth, but its absence early in the life of the plant caused a greater reduction than its absence later in life.

Omission of magnesium from the nutrient solution did not retard phosphorus absorption but did have a significant effect upon the movement and final location of phosphorus in the plants. The chemical composition of the component parts of the mature plants revealed that the magnesium-deficient plants contained a higher percentage of phosphorus in the vegetative organs and a lower percentage in the seeds than normal plants. A definite positive relationship existed between the magnesium and phosphorus content of the seed, and a definite negative relationship between the content of these two elements in the leaflets. This finding offers support to the theory that magnesium may function as a carrier of phosphorus in plants.

The magnesium-deficient plants absorbed slightly larger amounts of calcium and potassium on a percentage basis.

Structure Control

Aronofsky, J. S., Stein, N., and Willick, G. C. A NEW METHOD OF EVALUATING POROSITY AND SLIP-CORRECTED PERMEABILITY. Soil Sci. 79: 49-57. 1955.

A number of transient flow experiments were run on each of four cores with values of the cavity volume ranging from 0 to 1300 cc. Various combinations of the resultant experimental data were then used to calculate values for m, b, and ϕ.

Steady-state measurements of porosity had been made on each of four cores, and hence a direct comparison of the transient and steady-state values for ϕ could be made. On the other hand, the only steady-state measurements of permeability that were available were of the apparent permeability to gas at one average pressure between 1 and 2 atmospheres. It was therefore necessary to use the transiently determined values for m and b to calculate the apparent permeability at an average pressure corresponding to that used in the steady-state measurement and to compare these apparent permeabilities.

Bolton, E. F., Fulton, J. M., and Aylesworth, J. W. THE EFFECT OF TWO SOIL CONDITIONERS ON SOME PHYSICAL PROPERTIES OF A BROOKSTON CLAY SOIL. Canad. Jour. Agr. Sci. 35: 51-57. 1955.

The effects of two soil conditioners on some physical properties of a Brookston clay soil were studied during the 1952 and 1953 seasons. Formulation 931, a hydrolyzed polyacrylonitrile compound, incorporated at 0.10 and 0.05 percent concentrations by disking and by rotary tillage, did not produce significant changes in the physical properties studied. Formulation 6, a modified vinyl acetate maleic acid compound incorporated by rotary tillage at 0.10 and 0.05 percent concentrations, gave significant increases in aggregation and in total and noncapillary pore space. These physical improvements in the surface 6-inch depth had no effect on corn yield where fertilizer was applied in 1952 and had no effect on yield in either the unfertilized or fertilized plots in 1953. Formulation 6 produced a significant depression in corn yield where no fertilizer was applied in 1952.

Brockman, F. J., and Allenby, O. C. W. FACTORS AFFECTING THE LABORATORY EVALUATION OF SOIL CONDITIONERS. Can. Jour. Agr. Sci. 35: 27-35. 1955.

Routine procedures for the evaluation of synthetic soil conditioners are based on the determination of the degree of stability of conditioned aggregates when exposed to the slaking action of water. This investigation has shown that the stability values obtained in a typical procedure vary with the moisture content of the aggregates during preparation, with the manner of incorporating the conditioner, with the degree of drying and aging of the aggregates, and, under certain conditions, with the source of clay soil.

A procedure simulating practical application conditions was devised. Soil aggregate stability values given by this procedure were correlative with those obtained in the routine test when the aggregates for the latter test were prepared from soil of a crumbly consistency.

Chepil, W. S. THE EFFECT OF SYNTHETIC CONDITIONERS ON SOME PHASES OF SOIL STRUCTURE AND ERODIBILITY BY WIND. Soil Sci. Soc. Amer. Proc. 18: 386-391. 1954.

Beginning in 1951, a series of experiments was initiated on several soils for the primary purpose of determining the value of VAMA (a modified vinyl acetate maleic acid compound), and HPAN (a hydrolized polyacrylonitrile), for controlling erosion of soil by wind.

VAMA increased substantially the proportion of water-stable aggregates in all soils tested and decreased the proportion of the water-dispersible particles < 0.02 mm. in diameter. From this standpoint VAMA may be considered a very effective soil-aggregating agent. The great majority of the water-stable aggregates formed by VAMA, however, were of the size erodible by wind.

VAMA applied to the surface of the ground, or mixed with the soil, generally increased the erodibility by wind. The soils treated with VAMA were loose and friable and had a granular surface. The untreated soils were more or less cemented together and had a distinctly developed surface crust. The crust was resistant to wind erosion despite its unfavorable characteristics otherwise.

HPAN applied on top of the ground was ineffective in controlling erosion of soil by wind as early as 1 week after the application. Erosion, in fact, was increased in some cases due to the application of HPAN.

DeMent, J. D., Martin, W. P., Taylor, G. S., and Alban, E. K. EFFECT OF FIELD APPLICATIONS OF SYNTHETIC SOIL-AGGREGATE STABILIZERS ON PLANT EMERGENCE. Soil Sci. 79: 25-31. 1955.

Several commercially available, synthetic soil-aggregate stabilizers were tested for their effectiveness in increasing emergence of plants on Miami silt loam and Hoytville clay.

Depth treatment to 3 inches and treatment of the top 1/2 inch of the soil with liquid and solid forms of the chemicals, and combinations of depth and surface treatments were used. The chemicals reduced soil crusting wherever crust formation on the untreated plots was evident. Increased emergence of plants was obtained in 3 of the 5 tests conducted. There were increases in the stand of direct-seeded tomatoes on Hoytville clay and of corn, soybeans, and turnips on Miami silt loam; but there were no increases in the stand of lettuce, beets, and bush beans on Miami silt loam. Surface treatments with solutions of the chemical sprayed over the seed as a final operation were as effective in improving emergence as were depth treatments or combinations of depth and surface treatments.

Domby, C. W., and Kohnke, H. THE EFFECT OF FREEZING AND THAWING ON STRUCTURE OF THE SOIL SURFACE. Agron. Jour. 47: 175-177. 1955.

Investigations of the structure of the surface inch of bare and mulched Russell silt loam were conducted near Fafayette, Ind., for nearly 2 years. The greatest changes in structure of this soil occurred during the winter or early spring. The most rapid winter decrease in water-stability occurred where the soil was bare, but by the end of two winters most of the water-stable aggregates in the mulched soil also were broken down. Soil which was loose in the fall became compact during the winter, even where a surface mulch of 2 tons of straw per acre was present.

Haise, H. R., Jensen, L. R., and Alessi, J. THE EFFECT OF SYNTHETIC SOIL CONDITIONERS ON SOIL STRUCTURE AND PRODUCTION OF SUGAR BEETS. Soil Sci. Soc. Amer. Proc. 19: 17-19. 1955.

Two synthetic soil additives, VAMA and HPAN, were broadcast on a glaciated Williams loam subsoil at rates of 0, 500, 1,000, and 1,800 pounds per acre and rototilled to a depth of 6 inches with and without 20 tons of manure. Sugar beets were selected as an indicator crop to measure treatment differences. Nitrogen and phosphorus (P_2O_5) were side dressed each at the rate of 100 pounds per acre. Physical measurements included aggregate analysis, aeration porosity, water-holding capacity, total porosity, and bulk density.

In general, VAMA produced a greater change in the physical condition of the soil than HPAN irrespective of the determinations made. Percent aggregation for any given size range, the mean-weight diameter, and aeration porosity progressively increased as the rate of material applied was increased. Differences between mean-weight diameters and percent aggregation of untreated plots as compared to those which received 500 pounds of VAMA were significant, whereas 1,000 pounds of HPAN were required to obtain similar differences.

Islam, M. A., and Hossain, M. AGGREGATION OF EAST BENGAL SOILS IN RELATION TO THEIR CHEMICAL COMPOSITION. Soil Sci. 78: 429-434. 1954.

Representative soil samples from different parts of East Bengal were analyzed for their mechanical and aggregate composition. Maximum aggregation occurred in the coarse-sand fraction, followed by that in the fine-sand fraction. In a few soils, aggregation was found in the silt fraction. Aggregating capacity was expressed as stability index, which is the sum of the positive differences between the aggregate analysis and the complete mechanical analysis. The same soils were analyzed chemically to determine the amounts of moisture, loss or ignition P_2O_5, Fe_2O_3, Al_2O_3, K_2O, total exchangeable bases, total calcium, exchangeable calcium, soluble silica, organic carbon, and nitrogen.

Statistical analyses of the data showed the stability index was correlated at the 1-percent level with moisture, loss on ignition, clay, Fe_2O_3, and K_2O, and at the 5-percent level with Al_2O_3 and exchangeable calcium. Its correlation with other factors was negligible.

Jamison, V. C. THE EFFECT OF SOME SOIL CONDITIONERS ON FRIABILITY AND COMPACTIBILITY OF SOILS. Soil Sci. Soc. Amer. Proc. 18: 391-394. 1954.

The effect is reported of aggregate stabilization with vinyl acetate maleic acid copolymer upon the breaking strength (modulus of rupture) of soil briquets molded from several soils of known mineral composition at the moisture content equivalent to the one-third atm. point of the treated samples. Mostly the stabilization decreased breaking strength, the differences being greatest at the lower bulk densities. Soils rich in montmorillonite gave generally higher modulus of rupture values than those rich in kaolinite. Aggregate stabilization with this polymer also reduced compressibility of soils with 1:1 lattice type clay dominant, especially at the higher pressures used. The breaking strength of briquets and the water stability of the 1.0 to 0.25 aggregates tests were compared for several materials used to stabilize Lloyd clay aggregates. The various materials affected these two properties differently. A material that increased aggregate stability greatly does not necessarily reduce the briquet breaking strength appreciably. Inter-aggregate and intra-aggregate bonding is discussed in light of the results. Field and laboratory tests are reported showing that the method of soil treatment with a stabilizer and weather conditions after treatment will modify the effect upon soil crusts formed. Stabilizers sprayed on the surface may give rise to tough soil-plastic crusts that are harder than natural crusts upon drying.

Laws, W. D. THE INFLUENCE OF SOIL PROPERTIES ON THE EFFECTIVENESS OF SYNTHETIC SOIL CONDITIONERS. Soil Sci. Soc. Amer. Proc. 18: 378-381. 1954.

The influence of soil organic matter, soil acidity, free calcium carbonate, soil texture, type of clay mineral, and destruction and re-forming of stabilized aggregates on the effectiveness of the soil conditioners was studied. Wet-sieve aggregation data were expressed as mean weight-diameter, and the effectiveness of the conditioner was obtained by subtracting the mean weight-diameter of the untreated soil from that of the treated soil.

Oxidation of the soil organic matter greatly decreased the effectiveness of the soil conditioner. Adjusting acid soils to pH 6.3 to 7.0 with calcium carbonate increased the effectiveness of the soil conditioner, but the presence of free calcium carbonate in the soil appears to inhibit the effectiveness.

In synthetic soils the effectiveness of the conditioner reached a maximum of 15 percent clay where acid Cecil clay colloid was used. When base saturated colloids were used, the maximum effectiveness of the conditioner occurred at about 10-percent clay content. When applied to Texas soils, the conditioner was more effective as an aggregating agent on sandy loam and clay loam soils than on heavy clay soils.

Martin, J. P., and Aldrich, D. G. INFLUENCE OF SOIL EXCHANGEABLE CATION RATIOS ON THE AGGREGATING EFFECTS OF NATURAL AND SYNTHETIC SOIL CONDITIONERS. Soil Sci. Amer. Proc. 19: 50-54. 1955.

The aggregating effects of various natural and synthetic soil conditioners in normal soils and in soils varying widely in exchangeable cation percentages have been investigated. In the normal soils VAMA (a copolymer of vinyl acetate and the partial methyl ester of maleic acid), two dextrans from soil bacteria, IBMA (a copolymer of isobutylene and the half ammonium half amide salt of maleic acid) fructosan from Bacillus subtilis and mesquite gum exerted the greatest initial aggregating effect; carboxymethyl-cellulose and pectin exerted an intermediate effect; and ammonium alginate and arabogalactan (larchwood gum) exerted little or no binding action. Ammonium lignin sulfonate had a small initial effect which increased with time; it thus indicated dependence upon microbial activity.

The various soil exchangeable cation ratios greatly affected the aggregating action of some of the soil conditioners but had little influence on others. The binding action of VAMA was slightly reduced by 60-percent Na only, while that of IBMA (tested in Yolo loam soil only) was reduced by 10 to 60 percent Na and 30 to 60 percent K. The aggregating effect of polysaccharide type conditioners appeared to be directly related to the concentration of carboyxlic acid groups in these materials. As the concentration of uronic acid groups increased, the binding action of the materials increased with increasing exchangeable H and decreased with increasing exchangeable Na or K. Possible explanations for this behavior are discussed.

Montgomery, R. S., and Hibbard, B. B. THEORETICAL ASPECTS OF THE SOIL-CONDITIONING ACTIVITY OF POLYMERS. Soil Sci. 79: 283-292. 1955.

The soil-conditioning activity of polymers has been found to be a function of their "functionality", i.e., the ratio of the number of active groups per repeating polymer segment to the total weight of that polymer segment. The activity increases with functionality to an optimum value and then decreases again. This is probably because a low functionality the polymer does not have enough active groups to bind itself firmly to a soil particle, and at high functionality it has so many active groups that its water-solubility has increased to the extent that it is leached out of the soil.

In addition to functionality, the soil-conditioning activity of a polymer is a function of other factors, among which is molecular weight. The dependence of soil-conditioning activity upon molecular weight for sulfonated polystyrene was found to be closely associated with the number of sulfone crosslinks in the molecule. The activity was considerably lower when the number of crosslinks was large. When the molecular-weight effect was separated from the effect of cross-linking it was found that as the molecular weight increased, the activity rapidly increased to an optimum value. This optimum covered a rather broad molecular-weight range. After the optimum the activity slowly fell off again as the molecular weight was further increased. The molecular-weight-activity curves for the other types of active polymers are probably qualitatively similar to the sulfonated polystyrene curve. The shape of this curve is very similar to that of the molecular-weight-adsorption curves for polymers on activated charcoal. This and the functionality data indicate that the soil-conditioning activity of polymers is related to their adsorption by the soil particles.

It has been shown that the approximate relative strengths of the sulfonic-acid-soil, the carboxyl-soil, and the amide-soil bonds are 1.6, 1.0, and 0.8, respectively. In view of the fact that it is difficult to see how an amide could form a primary valence bond almost as strong as that formed by a carboxyl group and half as strong as that formed by the very ionic sulfonic acid group, it is the opinion of the authors that secondary valence or hydrogen bonds are involved in soil conditioning.

Mortensen, J. L., and Martin, W. P. DECOMPOSITION OF SOIL CONDITIONING POLYELECTROLYTES, HPAN AND VAMA IN OHIO SOILS. Soil Sci. Soc. Amer. Proc. 18: 395-398. 1954.

C^{14} labeled synthetic polyelectrolytes, HPAN (hydrolyzed polyacrylonitrile) and VAMA (a copolymer of vinyl acetate and maleic anhydride) were added Brookston silty clay loam and Hoytville silty clay, respectively, to determine the extent of decomposition of these compounds. In an incubation period of 130 days, radioactive carbon dioxide equivalent to 2.74 percent of the added HPAN and 0.20 percent of the added VAMA was produced as a result of microbial metabolism. The addition of 1-percent carbon as rye grass increased the decomposition of VAMA to 0.30 percent.

Microbial activity, as evidenced by CO_2 evolution, was increased by polyelectrolyte treatment and a correlation between total carbon loss and decomposition of polyelectrolyte is suggested. Biochemical aspects of polyelectrolyte decomposition in soil substrates are discussed.

Rennie, D. A., Truog, E., and Allen, O. N. SOIL AGGREGATION AS INFLUENCED BY MICROBIAL GUMS, LEVEL OF FERTILITY AND KIND OF CROP. Soil Sci. Soc. Amer. Proc. 18: 399-403. 1954.

A study was made of the effect in soil aggregation of microbial gums produced in vitro and in soil. Attention was also given to the effects of fertility treatments, kind of crop, and season on the aggregation of Spencer silt loam.

The bacterial polysaccharide synthesized by Agrobacterium radiobacter in pure culture had a marked aggregating effect when added to Spencer and Miami silt loams. Addition of as little as 0.02 gm. of this gum to 100 gm. of soil caused a 50-percent increase in aggregates > 0.1 mm. in diameter. The gum content of numerous samples of Miami and Spencer silt loams correlated well with their respective levels of aggregation. The addition of extracted soil gum to a poorly aggregated soil increased significantly the degree of aggregation.

Undecomposed pulverized plant residues added to soil increased the gum content to a maximum in 6 days. The maximum percentage of aggregates > 0.5 mm. in diameter was not reached until the 12th day.

Swanson, C. L. W., Hanna, R. M., and DeRoo, H. C. EFFECTS OF EXCESSIVE CULTIVATION AND PUDDLING ON CONDITIONER-TREATED SOILS IN THE LABORATORY. Soil Sci. 79: 15-24. 1955.

Laboratory tests were made to determine the effectiveness of three soil-conditioner chemicals on stabilizing soils and the effect of laboratory-stimulated normal cultivation, excessive cultivation, and puddling on breaking down the structure of these treated soils. The chemicals were applied for the purpose of setting up structural differences. Aggregate analyses were made of the soils by dry- and wet-sieving methods.

The untreated soil was more resistant under dry sieving than were the treated soils as expressed by a larger quantity of > 2-mm. aggregates and by greater total aggregation. This is the converse of the stability of the aggregates obtained by wet sieving. These data suggest that for maintenance of structure, cultivation of soils should be delayed until moisture is below field capacity.

Swanson, C. L. W., and Jacobson, H. G. M. EFFECT OF AQUEOUS SOLUTIONS OF SOIL CONDITIONER CHEMICALS ON CORN SEEDLINGS GROWN IN NUTRIENT SOLUTIONS. Soil Sci. 79: 133-146. 1955.

Corn seedlings were germinated and grown for 15 days in a gravel medium supplied with a nutrient solution. Half of the seedlings were harvested and the remainder treated as follows: In one experiment the nutrient solution was replaced for 42 hours by 0.2-percent solutions of NaPAN sodium acrylate and VAMA 6. In another experiment, 0.2-percent solutions of the chemicals were added to the nutrient solutions for 42 hours. In the last experiment, 0.025 M NaCl replaced the nutrient solutions, and 0.2-percent solutions of NaPAN and VAMA 6 were added initially to the nutrient solutions.

The NaPAN, VAMA 6, and 0.025 M NaCl solutions produced no deleterious effects on the corn seedlings. Plants grown in sodium acrylate solutions exhibited toxic effects on the second day of treatments. This suggests that sodium acrylate may have anesthetic or growth-inhibiting effects similar to those of ethylene or maleic hydrazide. Sodium generally increased in the corn seedlings, whereas K, Ca, and Mg showed inconsistent increases and decreases. When added directly to nutrient solutions, NaPAN and VAMA 6 produced suspended gelatinous phases. The data show losses of K from conditioner-treated roots were in the order NaPAN > Na acrylate > VAMA 6.

Taylor, G. S., and Baldridge, P. E. THE EFFECT OF SODIUM CARBOXYMETHYL-CELLULOSE ON SOME PHYSICAL PROPERTIES OF OHIO SOILS. Soil Sci. Soc. Amer. Proc. 18: 382-385. 1954.

The effect of sodium carboxymethylcelluloses (CMC) on soil aggregation, plasticity, moisture equivalent, 15-atmosphere-percentage, and water permeability was investigated in the laboratory. These compounds contained different degrees of substitution of sodium carboxymethyl groups, ranging from 0.32 to 1.28 substitutions per anhydroglucose unit. In general, increasing the degree of substitution resulted in greater soil aggregation, increased water permeability and larger plastic limits. Varying rates of CMC up to 0.5-percent concentration also resulted in significant increases in these soil characteristics. None of the compounds had any effect on the moisture equivalent and 15-atmosphere-percentage. The duration of aggregates stabilized by the 0.70 substitution was much less than those aggregates stabilized by the higher-substituted types.

Drainage

Bouwer, H. TILE DRAINAGE OF SLOPING FIELDS. Agr. Engin. 36: 400-403. 1955.

Transverse and longitudinal tile-drainage systems in uniform soils were compared with regard to their draining capacities. In the drainage literature, different opinions about this subject are found, and contradictory recommendations for the proper direction of tile lines with respect to field contours have been made.

In the course of this investigation, distinction was made between two cases. The first, where the phreatic surface coincided over the entire field with the ground surface, was studied by means of a model. The second, where the soil was not saturated to the surface and the flow system could seek its own phreatic surface, was approached mathematically.

The results showed that for both comparable longitudinal and transverse tile-drainage systems have the same draining capacities. On the basis of this result, it is recommended that tile lines (laterals) be installed at an angle between 10 and 30 deg with the contour lines. The lower limit of 10 deg is merely to indicate the practical undesirability of a tile parallel with the contours.

Schwab, G. O. PLASTIC TUBING FOR SUBSURFACE DRAINAGE. Agr. Engin. 36: 86-89. 1955.

Results of 5-year research study point up the physical and economic feasibility of perforated plastic tubing as a means of subsurface drainage of agricultural lands.

Irrigation

Allison, L. E., and Reeve, R. C. LYSIMETERS FOR STUDYING EFFECTS OF SALINITY, LEACHING, AND POSITION OF WATER TABLE ON PLANT GROWTH. Soil Sci. 79: 81-91. 1955.

Both the lysimeters and the irrigation-water storage reservoirs were constructed from concrete conduit pipe, cemented together and to a concrete base. A porous refractory brick was sealed into the base of each lysimeter to allow leachate from the soil to pass into a cavity below the brick and out through a galvanized iron pipe. Provision was made for collection of leachate for volume measurement and chemical analyses to determine rate of leaching and salt output.

For water-table control, each lysimeter was provided with a float-valve type of head-control device, which was arranged to move up and down on a control panel. The movable float-valves were connected in the line between the water reservoirs and the drainage pipes leading from the bottom of the lysimeters. The desired water-table levels were established at any point between the tops and the bottoms of the soil columns in the lysimeters by raising or lowering the float-valves on the control panels. For a light loam soil having good drainage properties, the rise of water table in response to upward float-valve adjustment was limited to less than 4 inches a day. When rapid rise of water table over a considerable distance was required, it was necessary to surface irrigate with excess water and allow the excess to drain off through the float-valve overflow.

Beauchamp, K. H. IRRIGATION GUIDE FOR NORTH CENTRAL STATES. Agr. Engin. 36: 31-34. 1955.

This paper presents an irrigation guide for the North Central States. It is based on combined experimental data on soils, crops, and engineering. It has the basic design criteria for all methods of irrigation water applications recommended for the soils, crops, climate, and water supply of the area under consideration.

Doneen, L. D. SALINATION OF SOIL BY SALTS IN THE IRRIGATION WATER. Amer. Geophys. Union Trans. 35: 943-950. 1954.

This paper is principally concerned with the salts of irrigation water which form salines in the soil. A method has been suggested for calculating the potential salinity of water and listed as effective salinity. New conversion factors have been listed for changing from milliequivalents to parts per million or pounds of salt per acre-foot for the soluble salts of effective salinity. A new standard has been suggested for the total salts of irrigation water based on the effective salinity, followed by a discussion concerning the application of this standard to irrigated agriculture.

Fisher, F. L., and Caldwell, A. G. NITROGEN REQUIREMENTS OF COASTAL BERMUDAGRASS UNDER SUPPLEMENTAL IRRIGATION AT COLLEGE STATION. Texas Agr. Expt. Sta. Prog. Rpt. 1731. 1954.

The effectiveness of soil moisture was greatly increased by raising the level of soil nitrogen. The greatest increase in efficiency of water applied was with the first 400 pounds of nitrogen. Twenty-two acre-inches of water were required to produce a ton of dry forage when no nitrogen was used, but only 7 acre-inches were needed per ton when 400 pounds of nitrogen were applied. A linear decrease of 1 acre-inch of water per ton of dry forage resulted from each additional 200 pounds of nitrogen above the first 400 pounds.

Hansen, V. E. INFILTRATION AND SOIL WATER MOVEMENT DURING IRRIGATION. Soil Sci. 79: 93-105. 1955.

There are three basic parts to the phenomena of water movement during irrigation--transmission zone, wetting zone, and wetting front. The transmission zone is characterized by an essentially constant hydraulic conductivity and approximately 80-percent saturation.

The wetting zone extends from the transmission zone to the wetting front, and the hydraulic conductivity and degree of saturation both are reduced as the wetting front is approached.

The wetting front is the foremost point of advance of the moving water, which becomes more difficult to define as the initial moisture content of the soil increases. The movement of the wetting front becomes more and more erratic as the initial moisture content is reduced. In the dryer soils the wetting front advances in a "jumping" motion. Rate of entry in moist soils is less than in dryer soils. The wetting front advances more rapidly when the soil is wet.

Hildreth, R. J., Fisher, F. L., and Caldwell, A. G. AN ECONOMIC EVALUATION OF EXPERIMENTAL RESPONSE OF COASTAL BERMUDAGRASS TO NITROGEN UNDER IRRIGATION. Tex. Agr. Expt. Sta. Misc. Pub. 128. 1955.

There is no one most profitable rate of application of nitrogen to irrigated Coastal bermudagrass under all price conditions. The most profitable rate of Lufkin fine sandy loam varies from 360 pounds per acre when hay is $15 per ton and nitrogen is $0.20 per pound to 921 pounds per acre when hay is $50 per ton and nitrogen is $0.10 per pound. The return on investment in nitrogen decreases as the amount of nitrogen applied increases.

Hoveland, C. S. EFFECT OF FERTILIZERS ON THE FORAGE PRODUCTION OF IRRIGATED OATS. Tex. Agr. Expt. Sta. Prog. Rpt. 1791. 1955.

An irrigated oat pasture on Frio silt loam soil near Crystal City was fertilized in October 1954 with various combinations of nitrogen, phosphoric acid, and potash. Half of the nitrogen was applied at that time and the remainder on January 4, 1955. Forage yields were taken by clipping. Production costs were calculated, and net income per acre was determined.

Nitrogen, at the rate of 120 pounds per acre, quadrupled the yield of air-dry forage over that of the no fertilizer treatment. A combination of 180 pounds of nitrogen and 60 pounds of phosphoric acid increased the yield 5 times and was the most profitable fertilizer treatment.

Howe, O. W., and Rhoades, H. F. IRRIGATION PRACTICE FOR CORN PRODUCTION IN RELATION TO STAGE OF PLANT DEVELOPMENT. Soil Sci. Soc. Amer. Proc. 19: 94-98. 1955.

An experiment involving 13 irrigation treatments was conducted on Tripp very fine sandy loam to study the importance of maintaining a low soil-moisture tension during different stages of plant development on corn production. Corn was planted in 30-inch rows on soil that was near field-capacity wetness to 6 feet, and a stand of 19,000 plants per acre was obtained. Soil-moisture determinations were made at the beginning of the season, before and after each irrigation, and at the end of the season. Net water input from irrigation was measured. Plant sampling was initiated 33 days after planting and repeated at weekly intervals in some treatments.

Corn production as shown by height measurements, dry-matter production, ear development, and yield of grain was materially influenced by irrigation. A low soil-moisture tension throughout the growing season was essential for obtaining maximum vegetative growth and a maximum yield of 153 bushels per acre; the total use of water was 21.4 inches with 14.2 inches supplied by irrigation. Three irrigations supplying 7.0 inches of water that maintained a low soil-moisture tension during the stage of growth before tasseling through silking produced 144 bushels per acre; the total use of water was 15.6 inches. The latter practice may be important where there is a shortage of irrigation water during the regular season, and the soil-moisture supply can be replenished by precipitation or a later irrigation. Where a high soil-moisture stress was alleviated during tasseling period by irrigation, there was an appreciable effect of that irrigation on yield of grain although the yield was appreciably less than where a low soil-moisture tension was maintained throughout the tasseling and silking period.

Hughes, W. F. COST AND RETURNS OF IRRIGATED PEANUT PRODUCTION IN THE WEST CROSS TIMBERS, TEXAS, 1953-54. Tex. Agr. Expt. Sta. Prog. Rpt. 1759. 1955.

Irrigated peanut production was studied in 1953 and 1954 on six farms in the Highlands community of Comanche and Erath Counties. Drought conditions prevailed both years. Yields of nonirrigated hay and nuts during 1953 was slightly below the average usually obtained in Erath County. Irrigated yields exceeded dryland yields 44 to 224 percent with little or no difference in peanut grades.

The relative difference between irrigated and nonirrigated yields was about the same in 1953 and 1954, but there was considerable difference in grade between irrigated and nonirrigated peanuts in 1954. Nonirrigated peanuts graded 48 to 52; irrigated peanuts graded 65 to 73. With the 1954 bonus, 48 grade peanuts sold for $1.85 per bushel; one lot of 73 grade peanuts brought $4.90 per bushel.

Jones, B. A., Jr., and Wakeland, H. L. SUPPLEMENTAL IRRIGATION OF PASTURES. Agr. Engin. 36: 181-184. 1955.

Management practices must be improved if returns from irrigated pasture are to pay the cost of irrigation. The 6-year average animal gain was increased 111 lbs. per acre, or 47 percent, on the irrigated field. However, at $0.20 per lb. of gain, this increase was not sufficient to pay operating and maintenance costs.

Animal-carrying capacity measured by pastured days was increased by 55 percent, or 103 pasture days.

Pruitt, W. O., and Jensen, M. C. DETERMINING WHEN TO IRRIGATE. Agr. Engin. 36: 389-393. 1955.

Rates of consumptive use of water by four crops grown at the Irrigation Experiment Station at Prosser, Wash., are presented. Rates of evaporation from a USDA, BPI evaporation tank, along with the estimated consumptive-use rates using the Blaney-Criddle and Thornthwaite procedures, are compared with measured consumptive-use rates.

During period of good crop cover, tank-evaporation rates gave a much closer estimate of actual consumptive-use rates than either the Blaney-Criddle or Thornthwaite procedure. Although high correlation coefficients resulted from statistically comparing each of the three methods with consumptive use, it was found that for the Blaney-Criddle method the value for the crop coefficient should vary throughout the season. Estimates of consumptive use with the Thornthwaite procedure fell short of actual consumptive use, but by applying a constant crop factor, depending on the crop, they were adjusted to provide closer correlation.

Rouse, H. K., Willhite, F. M., and Miller, D. E. HIGH ALTITUDE MEADOWS IN COLORADO: I. EFFECT OF IRRIGATION ON HAY YIELD AND QUALITY. Agron. Jour. 47: 36-40. 1955.

Four irrigation practices, two sod-management methods, eight fertilizer treatments, and two harvest-management systems were investigated on an area fairly representative of the better drained high altitude meadows in Colorado. Results of the irrigation investigations are reported. The practices were evaluated in terms of hay yield, percentage and yield of crude protein, percentage and removal of phosphorus, change in species composition, and quantity of water applied per ton of hay produced.

Intermittent irrigation practices produced hay of better quality with much less irrigation water than the continuous irrigation. The intermittent irrigation practice, however, did not result in significant increases in yield over the continuous irrigation except in the aftermath cutting.

Under intermittent irrigation, the application of nitrogen fertilizers at rates up to 160 pounds of nitrogen per acre resulted in lower percentages of crude protein than where no nitrogen had been applied. Under continuous irrigation the protein percentages were not greatly influenced by these rates of application of nitrogen. Under intermittent irrigation, yields of crude protein per acre were increased only when rates of application of nitrogen fertilizers of 160 pounds of nitrogen applied. Under continuous irrigation, yields of protein per acre were somewhat increased over no treatment by all rates of nitrogen fertilization.

Wilcox, J. E., and McDonald, J. M. WATER DISTRIBUTION PATTERNS FROM ROTARY SPRINKLERS. Canad. Jour. Agr. Sci. 35: 217-228. 1955.

Factors affecting the uniformity of distribution of water by rotating sprinklers were studied. Eight geometric curves of water distribution by sprinklers were selected. In addition, examples of such curves were selected from field tests for study. Always, various sprinkler spacings were assumed, both square and rectangular; the distribution of water between sprinklers was mapped; and the degree of uniformity of distribution within the areas studied was calculated. Conclusions reached were as follows:

(1) The best type of distribution curve for general application is one showing a steady decrease in rate of water application from the sprinkler out toward the outer circumference of water throw.

(2) The attainment of this type of curve does not of itself guarantee good water distribution. The uniformity coefficient and the range coefficient was suggested for evaluating the uniformity of distribution.

(3) With square spacing of the sprinklers, the spacing should not be greater than 60 percent of the diameter of the throw.

(4) On the average, square spacing of the sprinklers gives more uniform water distribution than does rectangular spacing covering the same area. This applies only to a condition of little or no wind.

Erosion Control

Chepil, W. S., and Woodruff, N. P. ESTIMATIONS OF WIND ERODIBILITY OF FIELD SURFACES. Jour. Soil and Water Conserv. 9: 257-266. 1954.

Three major factors influence erosion of soil by wind: surface roughness, vegetative cover, and degree of soil cloddiness. The authors indicate how these factors can be measured, how erodibility of a cultivated field surface can be determined, and what degree of surface roughness, vegetative cover, or soil cloddiness would be needed to reduce erosion to any degree. They believe that the guide presented in this paper can be used in helping the soil conservationist determine what practices can or cannot be used to control wind erosion on different soils.

Hawk, V. B., Hughes, H. D., and Schaller, F. W. REED CANARYGRASS HEALS GULLIES. Jour. Soil and Water Conserv. 9: 203-209. 1954.

Where there is a need for gully stabilization, reed canarygrass can do the job. For such use, this grass is in a class by itself. It will stand flooding, siltation, and drought. It can be propagated with seed, sod, or stems. It will stabilize gullies without shaping and provide an erosion-proof cover on shaped waterways.

Starting with a gully 15 to 20 feet deep and 30 to 40 feet wide in the erodible Ida-Monona soils of western Iowa, it was shaped into a waterway, tilled, and planted to a mixture containing reed canarygrass in the fall of 1946. The waterway was 60 to 80 feet wide, about 1/2 mile long, with a 60-rod lateral, and covered 8 acres. The watershed consisted of 300 acres with an average slope of 10 - 12 percent. An overfall at the lower end of the gully was stabilized with an 8 x 10 foot box type drop inlet with an 18-inch tube. The new seeding was protected by temporary diversion terraces along the sides of the waterway. Runoff was reduced by a soil-conserving rotation of C-C-O-M-M-M on the cropland, by terraces, by contour planting of corn, and by conservative management of pasturelands. After an excellent grass waterway was established, it was maintained by frequent inspections and repairs. As trouble spots developed, the rills were repaired with reed canary sods.

Together with the use of a supplemental structure, conservation practices on the watershed, and consistent maintenance, a properly established reed canarygrass waterway has taken the place of a canyon-like gully in the loessial soils in western Iowa.

Rai, K. D., Raney, W. A., and Vanderford, H. B. SOME PHYSICAL FACTORS THAT INFLUENCE SOIL EROSION AND THE INFLUENCE OF AGGREGATE SIZE AND STABILITY ON GROWTH OF TOMATOES. Soil Sci. Soc. Amer. Proc. 18: 486-489. 1954.

The object of this investigation was to obtain quantitative laboratory data on the primary effects and interactions of aggregate size and stability, rainfall rate, soil slope, and surface condition on soil erosion by water.

Sharkey clay was treated at three rates with a modified vinyl acetate-maleic acid compound to obtain three degrees of aggregate stability. The three soil samples were then separated into 5 size classes and subjected to the action of water under 3 different rainfall rates, 3 different slopes, and 2 different surface conditions.

In this study the size of aggregates had the greatest influence on the erosion of soil. As size was decreased from 1,000 to 500 μ size, there was a slight increase in erosion but a much greater increase occurred as size was decreased further. Surface condition, rate of rainfall, and aggregate stability have a significant influence on all aggregate sizes, but slope influenced only the erosion of small aggregates.

When 30 percent of the aggregates were water stable, the dry weight of both shoots and roots of tomato plants increased as the size of the aggregates increased. When 45 percent of the aggregates were water stable, however, the dry weight of both shoots and roots increased as aggregate size decreased.

Cropping Systems

Osborn, W. M., and Mathews, O. R. CROP ROTATION, TILLAGE, AND FERTILITY EXPERIMENTS AT THE LAWTON, OKLA. FIELD STATION, 1917-1949. U. S. Dept. Agr. Cir. 951. 1955.

Losses of nitrogen from the 0-6 inch layer of the soil while the land was under cultivation ranged from about 45 percent under continuous cropping to small grain to about 60 percent under continuous row cropping. Applications of stable manure were not effective in reducing losses of nitrogen, and plowing cowpeas under did not reduce the losses.

Tillage experiments with row crops and small grains indicated that timeliness of operations is important. Early tillage that destroyed weeds and left the land receptive to rainfall was much more productive than tillage beginning shortly before seeding or planting.

Plowing to a depth of about 8 inches gave better results than shallow tillage. There was little evidence that any crop other than corn was benefited by loosening the soil to a depth of 18 or 20 inches rather than to a depth of 8 inches.

Listing for small grains was not so productive as plowing. Listing as a substitute for plowing produced higher yields of corn, but produced much lower yields of other row crops than plowing.

The expensive practice of plowing under crops of cowpeas on rye increased yields somewhat, but not enough to compensate the loss of a harvest.

Yields of both row crops and small grains were increased by summer fallowing, but not enough to justify the practice. Fallowing as a preparation for growing wheat is justified under certain special conditions.

Residue Management

Lugo-Lopez, M. A., Bonnett, J. A., Hernandez-Medina, E., Landrau, P., Jr., and Samuels, G. SOIL ORGANIC MATTER LEVELS AND CROP YIELDS IN PUERTO RICO. Soil Sci. Soc. Amer. Proc. 18: 489-493. 1954.

No increases in organic matter content were observed in some latosols with an open porous structure and low fertility level when treated with different quantities of velvetbean green manure, sugarcane trash, and filter-press cake. Increased yields of corn were obtained only when the soil was treated with velvetbean green manure, probably because of increased nitrogen supply.

Definite increases in organic matter content were obtained with the above treatments in heavy-textured nonlateritic soils of moderate fertility but unfavorable physical conditions. Here increased yields of sugarcane and pineapple were obtained probably due to the favorable effect of increased amounts of organic matter on the physical conditions of the soils. The seven field experiments reported here have been established for relative short periods only, not over 7 years, but some of them are scheduled for long-time duration.

CROPS GENERAL

Fulkerson, R. S., and Tossell, W. E. SEED TREATMENT OF FORAGE LEGUMES AND GRASSES WITH THREE ANTIBIOTICS. Canad. Jour. Agr. Sci. 35: 259-263. 1955.

Aureomycin, penicillin, and terramycin were applied as seed treatments at several concentrations to five forage species. All three antibiotics stimulated seedling growth markedly in alfalfa, moderately in red clover, and not at all in timothy in greenhouse trials. No stimulation was detected in field trials with alfalfa, red clover, bromegrass, and reed canarygrass. The antibiotics had no effect on the number of seedlings established except in bromegrass where small variable differences were obtained.

Field Crops

Ahlgren, G. H., Pool, M., and Gausman, H. W. PERFORMANCE OF WINTER GRAINS ALONE AND WITH WINTER VETCH FOR SUPPLEMENTAL FORAGE. Agron. Jour. 46: 563-565. 1954.

A field study was conducted to determine at what stage of plant maturity winter grains seeded alone or with winter vetch should be harvested for hay. Winter grains used were wheat, rye, barley, and oats. Results justify the following conclusions:

Including winter vetch with winter grains notably increased the yield of protein per acre.

The average dry-matter yields of the small grains alone were similar to those obtained from the comparable small grain and vetch mixtures. Thus the addition of vetch did not significantly increase the total dry-matter yield per acre. Dry-matter yields of winter grains seeded alone were highest when harvest were made during the milk or dough stages.

The percentage of protein in winter grains seeded alone or with winter vetch was highest during the heading or milk stages. Protein per acre from winter grains seeded with vetch was highest when harvests were made during the milk or dough stage, exepting that of oats. Protein in oats-vetch hay was greatest when harvested at the heading or milk stage.

Winter barley seeded with winter vetch was superior to the other small grains seeded alone and with vetch in the production of dry matter and protein when harvesting was conducted during the dough stage.

Atkins, I. M., and Rivers, G. W. ALAMO OATS. Tex. Agr. Expt. Sta. Bul. 778. 1954.

This bulletin reports the development and characteristics of Alamo, a new dual-purpose oat variety now available to Texas farmers. Because of its high resistance to prevailing races of crown (leaf) and stem rust in Texas, Alamo can be grown in sections of south Texas where heretofore these diseases have prevented the growing of oats for grain.

The variety is especially well adapted to spring seeding throughout the northern part of the State. Its early maturity and strong straw make it suitable for use as a companion crop with sweetclover and for direct combining. Alamo has a plump, red seed which is practically free of awns and has a high test weight.

Alamo is susceptible to Helminthosporium blight; therefore, it should be grown in rotation or with nonsusceptible crops, and its seed should be treated with Ceresan M or other seed disinfectant. It is less cold resistant than Mustang or Red Rustproof strains, and should not be fall-sown north of approximately the Austin area of central Texas.

Bishop, R. F., Atkinson, H. J., and Parent, R. C. THE EFFECT OF LIMESTONE APPLICATIONS ON SOIL COMPOSITION, POTATO-SCAB DEVELOPMENT AND YIELDS OF POTATOES, BARLEY, AND CLOVER. Canad. Jour. Agr. Sci. 34: 573-581. 1954.

In a field experiment begun in 1931 at Charlottetown, Prince Edward Island, ground limestone, at rates of 500, 1,000, 1,500, 2,000, and 3,000 lbs. per acre was applied periodically for a 3-year rotation of potatoes, barley, and clover hay.

The analysis of soil samples, representative of the 0-6-inch depth, showed that by 1948 there was a close relation between the rates of limestone used and the pH values, exchangeable calcium content, and percent-base saturation. The analysis of subsoil samples showed that, by 1951, the effect of the limestone treatments was negligible at the 6-12-inch depth.

During the years 1940 and 1948, inclusive, there was evidence of increasing potato scab--a disease caused by Streptomyces scabies (Thaxter), Waksman and Henrici--particularly in plots receiving the higher rates of limestone. Consideration of crop yields for the same period showed that application of limestone had no effect on potato yields but resulted in significant increases in the case of barley and clover.

Brown, J. C., Holmes, R. S., Shapiro, R. E., and Specht, A. W. EFFECTS OF PHOSPHORUS AND COPPER SALTS ON IRON CHLOROSIS OF RICE IN FLOODED AND NONFLOODED SOIL AND THE ASSOCIATED ENZYMATIC ACTIVITY. Soil Sci. 79: 363-372. 1955.

Caloro rice (Oryza sativa) developed chlorosis, apparently due to iron deficiency when grown on a naturally calcareous soil that was not flooded, but did not develop chlorosis if the soil was flooded. Plants grown on the flooded soil had a higher catalase activity and a lower ascorbic acid oxidase activity than did plants grown on the nonflooded soil.

Rice grown on a flooded calcareous-organic soil mixture was very susceptible to chlorosis with increased additions of phosphorus and copper salts to the soil mixture. If the available copper supply was rather limited to the plants, they made good growth at relatively high phosphorus concentrations. Rice tolerated more copper when phosphorus was not used in the fertilizer. Phosphorus and copper, when added together, were found to be effective in limiting the absorption and utilization of iron by rice grown on the calcareous-organic soil mixture.

Christensen, P. D., and Lyerly, P. J. YIELDS OF COTTON AND OTHER CROPS AS AFFECTED BY APPLICATIONS OF SULFURIC ACID IN IRRIGATION WATER. Soil Sci. Soc. Amer. Proc. 18: 433-436. 1954.

Effects of sulfuric acid on crop yields and on some physical and chemical properties of a calcareous soil were investigated in a field experiment from 1947 through 1952. On cotton plots, the treatments consisted of applications of irrigation water containing no acid (pH 8.3), water acidified to pH 6, and water acidified to pH 2.3. Cotton was grown five seasons followed by sesbania the sixth season. A test on alfalfa was established using irrigation water not acidified and water acidified to pH 4. Alfalfa was grown for 3 years. The fourth year the alfalfa was plowed under and a crop of corn was raised.

Cotton yields on the acid plots relative to the checks became progressively higher (with two exceptions) from one year to the next; however, in only 1 year (1950) were differences in yield statistically significant. With sesbania following cotton, highly significant yield increases resulted from the high acid treatment. Alfalfa yields on the acid plots became progressively greater relative to the nonacid plots, but yield differences were not significant.

The results of this study support the view that soil acidification on calcareous soils may improve the soil physical conditions and result in increased yields, particularly in some crops. The application of acid in the irrigation water did not prove to be economically feasible.

Duncan, E. R. INFLUENCES OF VARYING PLANT POPULATION, SOIL FERTILITY AND HYBRID ON CORN YIELDS. Soil Sci. Soc. Amer. Proc. 18: 437-440. 1954.

Four experiments on widely different soil types were carried out in 1952 to study the influences of varying plant population fertility level and hybrid on yield of corn grain and on plant characteristics. Selected hybrids of three maturity ratings were used at each location. Corn yields were increased by an application of fertilizer, assumed to be adequate, at all locations. The degree of response to applied fertilizer was influenced by plant-population level, the initial fertility level of the soil, and to a lesser extent by the hybrids grown. Yield increases attributable to fertilizer ranged from 7.5 to 101.9 bushels per acre.

Grain levels of all hybrids were increased on the high fertility-level plots by increasing plant populations above 8,000 plants per acre. Lowest yields at this fertility level occurred at the lowest population, and best yields were obtained at the highest population (approximately 24,000 plants per acre). Yield responses to different populations were not consistent at the low fertility level. Responses varied with higher populations from slight increases to slight, but consistent decreases. Yield differences attributable to increasing plant populations from 8,000 to 24,000 plants, ranged from a decrease of 22.7 on the lowest fertility level to an increase of 64.8 bushels on the high fertility level. Intermediate populations at both fertility levels resulted in intermediate yield differences.

Keller, K. R. RELATIVE VALUE OF REPEATED ANNUAL FERTILIZER APPLICATIONS ON A PERENNIAL CROP, Humulus lupulus L. Agron. Jour. 46: 535-537. 1954.

Yield data were obtained from 5 consecutive years, 1949 to 1953, inclusive, from a 6^2 factorial fertilizer trial on the variety Fuggles grown in a commercial hop yard near Corvallis, Oreg. The results from the analyses of variance of harvest weights for individual years and for the 2-, 3-, 4-, and 5-year summaries indicated similar inferences. These results suggested that the conclusions drawn based on any single year of summary of 2 or more years were essentially the same although there were significant differences among years. Maximum mean yield response per plot for the 1-, 2-, 3-, 4- and 5-year summaries when using nitrogen alone were from the application of 225 and 300 pounds per acre, although no significant differences were indicated beyond the application of 75 pounds per acre. Consistent yield levels of the same magnitude as that for the higher yielding nitrogen rates were obtained from the application of 75 pounds of nitrogen in combination with 75 pounds of P_2O_5.

Mean net profit in dollars per plot based on harvest and fertilizer costs and price per pound of hops was computed. In general, expected mean net profit per plot followed closely the conclusions drawn for the yield data.

Fisher, F. L., and Reyes, L. CHLOROSIS IN SORGHUM IN THE RIO GRANDE PLAIN OF TEXAS. Tex. Agr. Expt. Sta. Prog. Rpt. 1737. 1954.

Successful control of sorghum chlorosis requires that the first application of copperas be made before plants are stunted. Experimental tests indicate that this must be done before the plants are 10 days old. A second spraying is applied within 14 days of the first. These first two sprayings should be applied over the entire field; then the schedule varied in accordance with field observation.

Results obtained to date indicate that 3 or 4 sprayings will give good control of sorghum chlorosis and result in good grain production. Only those areas where yellow-streaked plants develop should receive the 3 or 4 sprays. This yellowing usually will not develop in less than 14 days and may not appear before 35 days after the second spraying.

McEvoy, E. T. INTERACTION OF SODIUM AND POTASSIUM ON GROWTH AND MINERAL CONTENT OF FLUE-CURED TOBACCO. Canad. Jour. Agr. Sci. 35: 294-299. 1955.

An experiment with flue-cured tobacco grown in sand culture showed that sodium-potassium combinations in the nutrient supply had significant effects on yield and mineral content of the plants. The effects of variations in the K supply on yield was highly significant; that of Na was just below the level of significance. The Na X K interaction effect on yield was highly significant: at zero-K supply, yield increased with increased Na supply; but, at high-K supply, yield decreased with increased Na supply. When K was deficient, symptoms of K deficiency on the plants were reduced in severity by the addition of Na to the nutrient supply. It was indicated that, when K was deficient, Na partially supplemented or replaced K in the nutrition of the plants.

Na and K accumulated in the plants in direct relation to the supply. K depressed the uptake of Na by the plant, and the two elements had an additive effect in depressing the uptake of Ca, Mg, and P.

Schaller, F. W., and Larson, W. E. EFFECT OF WIDE SPACED CORN ROWS ON CORN YIELDS AND FORAGE ESTABLISHMENT. Agron. Jour. 47: 271-276. 1955.

Twelve experiments were conducted for a 3 year period to test the feasibility of establishing forage crops in corn planted in rows wider than normal and to determine the effect of row width on corn yields.

Data show that good yields of corn were produced in rows spaced as wide as 80 inches. In these studies 75 to 80 percent as much corn was grown in 80-inch rows as in 40-inch spaced rows.

To obtain good corn yields in wide rows, adequate plant populations per acre were necessary. It was indicated that plant populations per acre in 80-inch rows should not drop more than 25 percent below that considered best for 40-inch rows.

Establishment of forages in wide spaced corn rows during late June or early July met with fair success in 1952, 1953, and 1954. Rainfall was usually the most important factor determining the success or failure of forage seedings at the different locations in Iowa.

It was evident that widening the corn-row spacing greatly improved both the stand and growth of the interplanted crop. Uniform wide row spacing resulted in better stands and more growth than the system of alternate normal and wide spaced rows.

Staple, W. J., and Lehane, J. J. WEATHER CONDITIONS INFLUENCING WHEAT YIELDS IN TANKS AND FIELD PLOTS. Canad. Jour. Agr. Sci. 34: 553-564. 1954.

Thirty-one years' measurements of the influence of meterological factors on the yield of spring wheat grown in tanks and on field plots are described. Evapotranspiration, the sum of the stored moisture used from the soil plus the seasonal rainfall, was the most important single factor influencing crop yield. Stored moisture and rainfall were almost equally effective under the conditions of these experiments.

Linear regression between yield and evapotranspiration showed that the yield was increased by approximately 4 bushels per acre for each additional inch of water used. When the evapotranspiration was less than 5 or 6 inches no grain was produced. The distribution of the field-plot data was significantly curvilinear, indicating a greater increase in yield per inch of water used for high evapotranspiration.

Thaxton, E. L., Jr., Jones, D. L., and Box, J. GRAIN SORGHUM FERTILIZER TRIALS, HIGH PLAINS OF TEXAS, 1954. Tex. Agr. Expt. Sta. Prog. Rpt. 1789. 1955.

The application of 80 pounds of nitrogen per acre caused a significant increase in yield of grain sorghum on Pullman clay loam soil near Tulia in 1954. This treatment resulted in an increase of 1,250 pounds over the check plot. The application of 40 pounds of nitrogen and 80 pounds of phosphoric acid caused an increase of 1,907 pounds of grain sorghum per acre over the check plot at Lubbock on Amarillo fine sandy loam soil in 1954.

Vengris, J., Colby, W. G., and Drake, M. PLANT NUTRIENT COMPETITION BETWEEN WEEDS AND CORN. Agron. Jour. 47: 213-216. 1955.

Corn grown alone, corn grown with certain common weeds, and weeds grown alone on Merrimac sandy loam in Massachusetts responded to phosphate fertilization. Responses were most pronounced in the seedling stage.

Certain species, particularly pigweed, responded greatly to phosphate fertilization. In 1953, pigweed plants on low phosphate plots were weak and failed to grow, and many eventually died. Lamb's-quarters also grew poorly. Because the weeds in this experiment grew poorly in 1953 at low P levels, corn with weeds on the low P plots grew much better and produced much better yields than corn grown with weeds on plots receiving phosphate fertilizer.

Even the high rates of fertilization with nitrogen, phosphorus, and potassium fertilizers, weeds competed strongly for essential nutrients, suppressed the growth of corn, and resulted in decreased yields of corn.

Pasture and Range

Brooks, L. E., and Holt, E. C. COOL-SEASON GRASSES IN THE WICHITA VALLEY. Tex. Agr. Expt. Sta. Prog. Rpt. 1716. 1954.

Among the cool-season perennial grasses tested, tall fescue appears to be the best adapted to the Wichita Valley. Yields of 4,000 to 6,000 pounds per acre may be expected from pure stands of fescue under irrigation and with fertilization. By planting a fescue-alfalfa mixture, yields will be increased, and production throughout the year will be more uniform. No significant differences were observed in performance of named fescue strains. Since the winter and early spring growth is largely fescue and the summer growth largely alfalfa, winter and spring grazing and use of the summer crop as hay are suggested.

Brooks, L. E., and Holt, E. C. WARM-SEASON GRASS TESTS IN THE WICHITA VALLEY. Tex. Agr. Expt. Sta. Prog. Rpt. 1792. 1955.

Average yields of 3 to 4 tons per acre annually were produced under irrigation by the better adapted species in a warm-season grass yield test at Iowa Park. Coastal Bermuda, Blue panic, Johnsongrass, King Ranch bluestem, and Blackwell switchgrass were the higher producing grasses. Seasonal distribution of yield and total production in this test favor Coastal Bermuda as the best adapted species.

Cook, E. D., and Parmer, W. R. EFFECT OF RENOVATION AND FERTILIZER ON BERMUDAGRASS PASTURE. Tex. Agr. Expt. Sta. Prog. Rpt. 1777. 1955.

The effect of fertilizer and renovation on established Bermudagrass pasture was studied in 1952-54 on the Blackland Experiment Station.

The forage yields in the fertilized and fertilized-renovated plots were significantly greater each year than the check and renovated plots, except in 1952, when yields from the fertilized plots were not significantly greater than from the check and renovated plots.

This test shows that fertilization gives good increases in yield of grass but that renovation alone does not increase yields.

Cooper, C. S., and Sawyer, W. A. FERTILIZATION OF MOUNTAIN MEADOWS IN EASTERN OREGON. Jour. Range Mgt. 8: 20-22. 1955.

Nitrogen and phosphorus fertilizers were applied on native hay meadows in eastern Oregon in November 1951 and 1952. Nitrogen was applied as ammonium nitrate at 0, 20, 40, and 60 pounds of actual nitrogen per acre, and the phosphorus as treble superphosphate at 0, 40, 80, and 120 pounds of P_2O_5 per acre.

Nitrogen increased hay yields at all rates of applications with an increase of 1 ton per acre occurring with the 60 pound per acre rate of application. There were no additional benefits from nitrogen fertilization 1 year after application. Phosphorus increased hay yields 1/3 tons per acre in the year of application, and 1/5 ton per acre in the year following application. No additional benefits were obtained from phosphorus application rates higher than 40 pounds P_2O_5 per acre.

Phosphorus stimulated the growth of white-tip clover. Increased clover production, through the use of phosphorus and management practices, resulted in an increase in crude protein content of hay of 6.49 percent. Site selection was important as response was poor on alkaline knolls and in the deep swales which were submerged to a depth of more than 1 foot. Additions of both nitrogen and phosphorus were an economical means of increasing hay production.

Crowder, L. V., Sell, O. E., and Parker, E. M. THE EFFECT OF CLIPPING, NITROGEN APPLICATION, AND WEATHER ON THE PRODUCTIVITY OF FALL SOWN OATS, RYEGRASS, AND CRIMSON CLOVER. Agron. Jour. 47: 51-54. 1955.

A mixture of Arlington oats, domestic ryegrass, and Dixie crimson clover was sown in plots at Experiment, Ga., in mid-September of 1947, 1948, and 1949. Beginning in October and continuing for 6 months the plots were topdressed with monthly applications of 16, 32, and 48 pounds of nitrogen per acre. Clipping was begun in November and spaced at intervals of 2, 4, and 8 weeks.

Dry-matter yields were greatest with the longest interval between clippings (the 8-week treatment). Little difference in productivity occurred between the 2- and 4-week intervals during the fall. However, the 4-week clipping treatment resulted in more forage production during the winter and spring than did the 2-week interval. These results indicate that regulated or rotational grazing should be practiced, particularly in the fall and early winter when growth is largely dependent on rainfall and temperature.

Monthly nitrogen topdressing applications did not alter the forage yields during the fall and early winter. However, the production of dry matter in late winter and early spring was increased as the increments of nitrogen application were raised from 16 to 32 and 48 pounds per acre.

Dix, R. L., and Butler, J. E. THE EFFECT OF FIRE ON A DRY, THIN-SOIL PRAIRIE IN WISCONSIN. Jour. Range Mgt. 7: 265-268. 1954.

Studies were made of mulch accumulation, flower stalk production, cover, and plant height of important grasses for two growing seasons in the burned and unburned portions of a thin-soil prairie in southwestern Wisconsin.

It is suggested that a better understanding of the effects of fire on native grasslands is to be found in careful observations and measurements of the responses by individual species within the grassland rather than in the response of the "grassland community".

Hoveland, C. S. EFFECT OF EARLY CLIPPING ON THE FORAGE PRODUCTION OF OATS. Tex. Agr. Expt. Sta. Prog. Rpt. 1784. 1955.

Results of a greenhouse clipping experiment at the Winter Garden Experiment Station indicate that early clipping or grazing of young oat pastures should be avoided in order that the plants may develop sufficient root systems.

Grazing of irrigated oat pastures should probably not be started until the plants are 10 to 12 inches tall. In southwest Texas, this will be about the end of November or first of December.

Jacobs, J. A., and Oldemeyer, D. L. THE RESPONSE OF FOUR VARIETIES OF ALFALFA TO SPRING CLIPPING, INTERVALS BETWEEN CLIPPINGS, AND FALL CLIPPING IN THE YAKIMA VALLEY. Agron. Jour. 47: 169-170. 1955.

Four varieties of alfalfa were grown for hay production under various clipping schedules which included spring clipping; 25-, 30-, and 40-day intervals between cuttings; and fall clipping. The schedules were arranged so that the date of the last cutting of all plots, except the fall cutting, was August 30. The treatment schedules were followed in 1950-51. In 1952, all plots were harvested uniformly with 3 cuttings to measure any residual effects that resulted from previous treatments. Significant reductions in yield resulted from more frequent clipping. In 1951, the average yield for the 25-day interval of clipping without a spring clipping was 5.90 tons per acre as compared with 7.13 tons per acre for the 40-day frequency without spring-clipping, a reduction of more than 1 ton per acre by cutting 5 times rather than 3.

Joy, C. R., Helwig, L., Reiger, T., and Supola, M. A COMPARISON OF GRASS GROWTH ON DIFFERENT HORIZONS OF THREE GRASSLAND SOILS. Jour. Range Mgt. 7: 212-214. 1954.

Vegetative responses of beardless wheatgrass and cheatgrass seedlings grown on separate soil horizons were evaluated in a greenhouse study on dark, medium, and light chestnut soils of western Montana.

Height measurements made at 30-, 60-, and 90-day intervals showed that maximum growth of both species took place in the surface 6-inch horizon of all soils. Height growth was greatest in the dark chestnut soil and least on the light chestnut soil.

Herbage and root weights showed trends similar to those of height growth. Maximum weights were obtained from plants grown in surface horizons. Herbage and root weights were greatest on the dark chestnut soil.

Differences in herbage and root weights obtained on the separate soil horizons appeared to be more closely related to differences in organic matter and nutrient content than to textural characteristics of the soils.

Merrill, L. B., and Young, V. A. RESULTS OF GRAZING SINGLE CLASSES OF LIVESTOCK IN COMBINATION WITH SEVERAL CLASSES WHEN STOCKING RATES ARE CONSTANT. Tex. Agr. Expt. Sta. Prog. Rpt. 1726. 1954.

Cattle grazed alone in native pastures from 1949-50 through 1953-54 made less gains per head and per acre than those grazed with goats or with sheep and goats. The differences were comparatively small the first 2 years but were pronounced during the last 3 years. No marked advantage in weight gain was shown by cattle grazed with goats over those grazed with sheep and goats. Sheep grazed alone made less body-weight gains per head and per acre than did sheep grazed with cattle and goats. This was true for all years and all stocking rates except for 1952-53 when sheep grazed alone at the light rate of stocking made a slightly higher gain than those on lightly stocked pastures carrying cattle, sheep, and goats.

Miller, D. E., Willhite, F. M., and Rouse, H. K. HIGH ALTITUDE MEADOWS IN COLORADO: II. THE EFFECT OF HARVEST DATE ON YIELD AND QUALITY OF HAY. Agron. Jour. 47: 69-72. 1955.

An experiment was conducted on a high altitude hay meadow near Gunnison, Colo., to determine the effects of harvesting at different stages of maturity on the yields of hay and percentages, yields of crude protein and percentages, and total uptakes of phosphorus. Use of nitrogen and phosphorus fertilizers was also studied.

The data indicate that the plants continue to increase in dry weight throughout the season. However, when forage was harvested early in the season and the regrowth included in the total yield of hay, there were no significant differences in the total hay produced regardless of the time of the initial harvest.

Mueggler, W. F., and Blaisdell, J. P. EFFECT OF SEEDING RATE UPON ESTABLISHMENT AND YIELD OF CRESTED WHEATGRASS. Jour. Range Mgt. 8: 74-75. 1955.

A study was begun in 1945 to determine the effects of seeding rate upon establishment, survival, and yield of crested wheatgrass. Fall plantings were made at rates of 2, 4, 8, 12 and 24 pounds of seed per acre for 3 years at three locations on the Upper Snake River Plains.

Within the first 3 years after planting, the effect of seeding rate on stand establishment was very noticeable. During this period stands seeded at 2 and 4 pounds per acre contained fewer plants per foot of drill row and on the whole were not considered as successful as stands seeded at 8, 12, and 24 pounds per acre. By the sixth year, all stands were producing a like amount of herbage regardless of initial seeding rate.

Pearse, C. K., METHODS AND PROCEDURES FOR SUCCESSFUL RESEEDING OF RANGELANDS. Sixth Internatl. Grassland Cong. Proc. 534-539.

Successful reseeding of native rangelands require the selection of favorable sites, choice of adapted species, use of effective and economical methods and procedures for establishing the stand, and proper management of grazing the reseeded range. This paper is concerned only with problems of preparing the site, planting the seed, and getting the stand established.

Sandal, P. C., and Garey, C. L. EFFECT OF TOPDRESSING PERMANENT PASTURES WITH SUPERPHOSPHATE ON BEEF YIELDS AND DISTRIBUTION OF AVAILABLE P_2O_5 IN THE SOIL. Agron. Jour. 47: 229-231. 1955.

A study was made to determine the available P_2O_5, organic-matter content, and soil-structure characteristics in 1-inch layers of the top 6 inches of soil in Bermuda-legume pasture in the Ozark Uplands in Arkansas fertilized annually for 7 years with 0, 200, and 600 pounds of superphosphate.

Pastures topdressed annually with 0, 200, and 600 pounds of superphosphate produced 61, 275, and 382 pounds of beef per acre, respectively.

The concentration and depth of P_2O_5 movement in the soil was dependent primarily on the rate of P_2O_5 applied. Penetration of adequate amounts of P_2O_5 for plant growth did not occur below the 3-inch depth at the moderate rate of phosphate fertilization, whereas considerable penetration occurred to a depth of 6 inches under heavy fertilization. The relationship between soil type and climate in relation to phosphorus movement in the soil is discussed.

A consistently higher organic-matter content and improved soil structure in the various layers of the topsoil were associated with increased rates of phosphate fertilization.

Smith, L. F., Campbell, R. S., and Blount, C. F. FORAGE PRODUCTION AND UTILIZATION IN LONGLEAF PINE FORESTS OF SOUTH MISSISSIPPI. Jour. Range Mgt. 8: 58-60. 1955.

A cooperative study of range-forage production was conducted on the McNeill Experimental Forest in south Mississippi from 1947 to 1953. Steers were grazed in four experimental pastures on the area from 1950 to 1952, to compare cattle gains during a 4-months' spring season with a 7-months' spring-summer season.

The most abundant forage species were little bluestem and slender bluestem. Other upland grasses included several panicums, three-awn, dropseed, paspalums, and carpetgrass. In 3 years, maximum yields of grass were 850, 450, and 400 pounds (air-dry) per acre in open, moderate, and dense pine stands, respectively. Heavy pine litter rendered much of the grass in dense pine stands unavilable to cattle. On unburned range, maximum grass production ranged from 1,375 pounds (air-dry) per acre in a summer with ample rainfall to 474 pounds in a dry summer.

Torrie, J. H., and Hanson, E. W. EFFECTS OF CUTTING FIRST YEAR RED CLOVER ON STAND AND YIELD IN THE SECOND YEAR. Agron. Jour. 47: 224-228. 1955.

The effects of cutting red clover in the fall of the seedling year on stand, vigor, and forage yield in the following year were studied at Madison, Wis. Comparisons were also made of the effects of removing and not removing the clippings from the field after cutting.

The effects of these practices varied from year to year, depending on growing conditions during the seedling year, the severity of the winters, and other factors. Clipping in late August was sometimes very beneficial and was never harmful. Cutting on September 15 or later was injurious in 3 of 4 tests and never increased yields. Removing the clippings immediately after cutting reduced the amount of weeds and straw in the hay the following year and gave substantial increases in yields in some years. In general, best results were obtained when the first year's growth was clipped August 31 and the clippings removed from the field.

Turner, G. T., and Dortignac, E. J. INFILTRATION, EROSION, AND HERBAGE PRODUCTION OF SOME MOUNTAIN GRASSLANDS IN WESTERN COLORADO. Jour. of Forestry 52: 858-860. 1954.

Results of this study show that both dense and open stands of Thurber fescue provide abundant forage and ample watershed protection. Lush weed sites, when managed to prevent soil exposure and compaction, also give good watershed protection. The lush weed type furnishes little forage for cattle but is satisfactory for sheep and game.

The blue grass type normally produces adequate forage yields and the sod prevents excessive erosion from the site. Yet the volume of surface runoff from this type is greater than that from other grassland types. The high volume of runoff from any appreciable area of bluegrass may cause gullying and channel cutting on lower lying lands. The needlegrass type is not a good forage producer and unless carefully managed can deteriorate to a condition where serious erosion occurs. Management to increase the density of the more desirable grasses will benefit both forage production and watershed protection.

Willhite, F. M., Rouse, H. K., and Miller, D. E. USE OF BEEF CATTLE FEEDING DATA IN EVALUATING MOUNTAIN MEADOW MANAGEMENT PRACTICES. Jour. Anim. Sci. 13: 808-816. 1954.

Early cut hay is far superior to late cut hay in feeding value. In 1950, 1 pound of 43-percent crude protein cake supplement per animal per day was required to raise the feeding value of a late cut hay ration to equal that of early cut hay. The use of nitrogen and phosphorus fertilizers did not affect the feeding value of the hay significantly.

A direct relation was found between pounds of crude protein available daily in a ration and the rate of animal gain. A method is suggested for utilizing this relation in converting yield and protein analysis data into corresponding beef production. The method has possible value in interpreting the results of water control, harvest management, fertility, or other practices in terms of the end product of a ranch--pounds of beef per acre.

Analysis of agronomic data may be made on the dry-matter basis; however, where forage is used exclusively for livestock feed, combining dry matter and quality to express the data as livestock gain gives a more complete picture of the results obtained.

Willhite, F. M., Rouse, H. K., and Miller, D. E. HIGH ALTITUDE MEADOWS IN COLORADO: III. THE EFFECT OF NITROGEN FERTILIZATION ON CRUDE PROTEIN PRODUCTION. Agron. Jour. 47: 117-121. 1955.

High rates of nitrogen ranging from 0 to 960 pounds per acre were applied to a mountain meadow near Gunnison, Colo., in 1952 and 1953, and their effects of hay and crude protein production were studied. The residual effects of the 1952 applications were studied in 1953. In addition, a two harvest system (early harvest plus aftermath) and a late harvest were compared.

Hay yields were greatly increased by nitrogen fertilization. The highest rates of nitrogen gave the greatest residual effects the year following application. Protein percentages were generally increased by rates of nitrogen of 320 pounds per acre or greater. A tendency toward decreased protein percentages from the low nitrogen rates was observed.

A biennial application of nitrogen fertilizer was as good as or better than an equal total amount of nitrogen applied annually at rates of one half the total amount of each year, as measured by total protein production for 2 years. A two harvest system is apparently necessary to obtain full benefits of the high rates of nitrogen fertilizer.

Wilson, C. M. THE EFFECT OF SOIL TREATMENTS ON THE TANNIN CONTENT OF LESPEDEZA SERICEA. Agron. Jour. 47: 83-86. 1955.

Five field experiments representing five soil types and a greenhouse experiment on one soil type were conducted to determine the effect of rates of fertilizers and lime on the tannin content of sericea.

The only major difference measured was a decrease in tannin in plants getting K_2O at the rate of 60 pounds per acre as compared to those without K_2O. This difference was obtained on a Norfolk loamy sand in greehouse pots, and it occurred in the third crop year after plants were showing extreme deficiency symptoms and yields were severely reduced on the no-potash treatment.

It is concluded that mineral fertilizers and lime have little if any effect on the tannin content of sericea, except where nutrients are limited to the point that plant growth is severely inhibited. It appears that where a nutrient deficiency does limit growth of sericea the tannin content may be significantly increased.

Vegetable Crops

Heeney, H. B., Bishop, R. F., and Hill, H. THE RELATIONSHIP OF SOIL PHOSPHORUS TESTS TO CROP YIELD AND TO THE REQUIREMENT OF THE TOMATO FOR PHOSPHATIC FERTILIZER. Canad. Jour. Agr. Sci. 35: 11-18. 1955.

Field and laboratory investigations relative to the production of canning tomatoes in Price Edward County, Ontario, were conducted for 4 years. The study, designed to establish correlation tables between phosphorus soil-test values and crop response to phosphatic fertilizer, included soils of varying texture and reaction. Bray's method for adsorbed and easily acid soluble phosphorus as well as one employing a 1-percent solution of K_2CO_3 as extractant were used to obtain estimates of available soil phosphorus. Yields from plots receiving no phosphorus were expressed as a percentage of those from plots receiving phosphorus. Adequate amounts of nitrogen and potassium were applied in all cases.

The percentage yields plotted against the soil-test values resulted in a curvilinear relation similar to that for the Law of Diminishing Returns. This provided a basis for predicting the percentage yield to be expected for various soil-test values. Of the two chemical procedures used Bray's gave the most consistent results. This method showed that a soil-test value of approximately 250 pounds per acre of phosphorus (P) may be expected to give 90 percent of the maximum yield. Preliminary results relative to the amount of phosphatic fertilizer required to give maximum yield for various soil test values are presented.

Tree Fruits and Nuts

Aldrich, D. G., Buchanan, J. R., and Bradford, G. R. EFFECT OF SOIL ACIDIFICATION ON VEGETATIVE GROWTH AND LEAF COMPOSITION OF LEMON TREES IN POT CULTURES. Soil Sci. 79: 427-437. 1955.

A comprehensive study involving 4 old citrus soils and 4 corresponding noncitrus soils from 4 localities in southern California has been conducted with lemon trees grown in pot cultures in the greenhouse in an effort to determine the value of soil acidification as a management practice for alkaline soils.

Appropriate additions of sulfur to the eight soils produced levels of reaction ranging in approximately unit decrements from above pH 8.0 to slightly less than pH 4.0. Results of these treatments indicate that acidification produced significant differences in lemon tree growth and that there is a positive, significant correlation between growth and pH for each soil studied As the soils became more acid with treatment, growth decreased. Growth data also reveal that at any particular pH level lemon trees generally grow larger in noncitrus soil than in corresponding old citrus soil.

Toenjes, W. THE RESPONSE OF BARTLETT PEAR TREES UNDER SOD MULCH AND CLEAN CULTURE SYSTEMS OF SOIL MANAGEMENT. Mich. Agr. Expt. Sta. Quart. Bul. 37: 363-374. 1955.

The data presented in this report indicate that, under the conditions of this experiment, the sod-mulch system of soil management is adapted for use in Bartlett pear orchards in Michigan.

Alfalfa and, later, the grass-sod cover, retarded growth and fruit production of the pear trees for the first 12 years after it was established. From then on, the trees made greater trunk circumference increase, produced heavier annual crops, and larger fruit under sod-mulch culture, than did trees in the clean-culture plots.

At the end of the experiment, trees under the fertilized sod-mulch system had produced a total of 1,136 bushels more fruit per acre than did the fertilized trees under clean culture. Likewise, they produced 80 percent more fruit above 2-1/4 inches in size during the 6 years that the fruit was size graded.

Woodbridge, C. G. ZINC DEFICIENCY IN FRUIT TREES IN THE OKANAGAN VALLEY IN BRITISH COLUMBIA. Canad. Jour. Agr. Sci. 34: 545-551. 1954.

In the Okanagan Valley of British Columbia a zinc deficiency was found to occur on apple, pear, cherry, peach, apricot, and prune fruit trees. The severity of the deficiency varied considerably from orchard to orchard. In some, the severity was very marked, and death of some tissues had occurred. In others, the deficiency was moderate, and some or all of the characteristic symptoms usually associated with it, viz., small leaves, leaf rosettes, and an interveinal chlorotic pattern, were present. When the deficiency was slight, one or more of these symptoms were recognizable only at certain times of the growing season. With the exception of cherry, affected trees responded well to zinc sulphate sprays when applied during the late dormant period. Summer sprays of zinc oxide and the injection of various zinc compounds into the trunks of affected trees were less effective. A good correlation between the zinc content of tissues and the presence of deficiency symptoms was established.

Woodbridge, C. G. THE BORON REQUIREMENTS OF STONE FRUIT TREES. Canad. Jour. Agr. Sci. 35: 282-286. 1955.

A study was made in Canada of the syndromes associated with boron deficiency and excess on peach, apricot, prune, and cherry trees grown in sand culture. On the four types of fruit trees examined boron deficiency was characterized by a spring die-back of branches. Symptoms of toxicity varied considerably: on peach, brown necrotic marks on the underside of the main rib of the leaf were most characteristic; on apricot, swelling of the nodes; on prune, cracking and sloughing off of bark on 2-year-old twigs; and on cherry, die back of terminals accompanied by gumming. Results of chemical analyses indicated that there was a close relation between the boron content and expression of tree symptoms.

PEST CONTROL

General

Bleak, A. T., and Miller, W. G. SAGEBRUSH SEEDLING PRODUCTION AS RELATED TO TIME OF MECHANICAL ERADICATION. Jour. Range Mgt. 8: 66-69. 1955.

The effects of season of brush eradication on production of sagebrush seedlings, the survival of original sagebrush plants, and the establishment of crested wheatgrass seedlings were studied on two adjoining reseeding projects in Nevada. The evaluations were made in the summer of 1953 on more than 10,000 acres of sagebrush lands cleared with offset disk harrows and wheatland-type plows from April to November 1952. These areas were planted to crested wheatgrass during late summer and fall of 1952.

The number of mature sagebrush plants remaining after treatment was greatest on areas worked during the spring. The proportion of surviving plants decreased on summer-cleared lands but increased markedly on areas worked in October and November.

A moderate number of sagebrush seedlings developed on the area cleared during the spring months probably from seed produced by plants surviving eradication. Seeding establishment was negligible on summer-cleared areas but large numbers were found on areas cleared after mid-October.

Lyerly, P. J., and Stith, L. S. CONTROL OF EARLY WEEDS IN THE EL PASO VALLEY, 1954. Tex. Agr. Expt. Sta. Prog. Rpt. 1779. 1955.

Irrigated fields in the El Paso Valley usually are relatively free of annual weeds until after the cotton is 3 to 4 weeks old. Following early summer irrigation, however, the control of such weeds frequently becomes a serious problem.

Several Alanap herbicides applied as pre-emergence sprays in cotton on the El Paso Experiment Station at Yaleta retained their effectiveness for 6 weeks and longer and gave good weed control following early summer irrigations in 1953 and 1954.

Murphy, A. H. VEGETATIONAL CHANGES DURING BIOLOGICAL CONTROL OF KLAMATH WEED. Jour. Range Mgt. 8: 76-79. 1955.

Changes in vegetational composition were studied on two Humboldt County, Calif., range areas from 1948 to 1953 during biological control of Klamath weed. Set-grazing periods in spring and summer were run in conjunction with the study until 1951. In all cases where beetles were noted to be feeding during the late spring and summer, Klamath weed was reduced to a minor part of the forage or completely eliminated the subsequent year. Both the annual grasses and forbs were aggressive competitors for the vacated space. In one case annual grasses were most aggressive but in two other cases forb and annual grasses were equally aggressive. Out of three trial areas, the perennial grasses increased in percentage density in only one area. Weedy grasses, such as Medusa-head, showed some increase.

Waldrip, W. J. BRUSH CONTROL, GRAZING MANAGEMENT AND REVEGETATION OF AREAS INFESTED WITH BLUEBERRY CEDAR. Tex. Agr. Expt. Sta. Prog. Rpt. 1721. 1954.

Blueberry cedar should be removed from most rangelands in the Edwards Plateau and Grand Prairie grazing regions. Regardless of the method of clearing, cedar removal usually results in increased forage production. Grazing on all cleared pastures should be deferred for at least one growing season following clearing. If the cedar slash is burned, deferment is highly essential. In most instances, a seed source of the better forage plants should be provided following cedar clearing.

FORESTRY, WOODLOTS, SHELTERBELTS

Aird, P. L., and Stone, E. L. SOIL CHARACTERISTICS AND THE GROWTH OF EUROPEAN AND JAPANESE LARCH IN NEW YORK. Jour. Forestry 53: 425-429. 1955.

The relation between the site indexes of European and Japanese larch and various soil and site features in southern New York indicated growth is most closely related to soil-drainage class and to depth of soil above a layer restricting root development. These two soil characteristics were highly correlated with each other and with several other site factors. In consequence, multiple regression equations proved but slightly more useful than simple regressions with depth or drainage in providing guides for productivity estimates. The two species reacted similarly to the soil-site factors tested, giving no indication that Japanese larch is more tolerant of impeded soil drainage.

Within the area represented, site productivity for the two larches can be estimated by means of the depth and drainage relations or through soil type groupings.

Allen, R. M., and Maki, T. E. RESPONSE OF LONGLEAF PINE SEEDLINGS TO SOILS AND FERTILIZERS. Soil Sci. 79: 359-362. 1955.

A pot study was made on three different soils: a sandy soil, an eroded soil, and topsoil. Three fertilizer treatments were used with each soil: control, nitrogen, NPK. The pots were sown with longleaf pine seed in spring, and the seedlings were lifted the following spring. A portion of the seedlings were planted in sand in a greenhouse for a drought test.

Survival after transplanting was affected by the medium in which the seedling grew prior to transplanting. Those grown in the eroded soils and the topsoil were about the same in green weight when lifted and were very much alike in all outward appearances. In the first examination after being transplanted, the seedlings from the eroded soil showed considerably lower survival than did those from the topsoil. In the second examination the trends were generally similar, except that with the NPK treatment survivals were 64 and 87 percent for the eroded soil and for the topsoil when the seedlings were kept moist, but 53 and 27 percent, respectively, after they were subjected to low moisture.

Austin, R. C., and Baisinger, D. H. SOME EFFECTS OF BURNING ON FOREST SOILS OF WESTERN OREGON AND WASHINGTON. Jour. Forestry 53: 275-280. 1955.

The measurable physical and chemical effects on the forest soil of burning logging slash are confined to the top 2 inches of soil depth and usually are concentrated in the 1/2- to 1-inch depth zone. Two years after burning, the soil in the study plots had only partly readjusted to normal.

Blow, F. E. QUANTITY AND HYDROLOGIC CHARACTERISTICS OF LITTER UNDER UPLAND OAK FORESTS IN EASTERN TENNESSEE. Jour. Forestry 53: 190-195. 1955.

The quantity of litter found in several upland oak stands in eastern Tennessee ranged from 2 to 12 tons per acre. Fire, cutting practices, and stand composition are factors that cause variations in the little layer. On one mixed oak stand annual leaf fall added an average of 1.3 tons of litter to the forest floor. Total litter reached a peak of 5.4 tons in December following leaf fall and then decreased to a fairly stable low August weight of 4.2 tons.

Fletcher, H. C., and Rich, L. R. CLASSIFYING SOUTHWESTERN WATERSHEDS ON THE BASIS OF WATER YIELDS. Jour. Forestry 53: 196-202. 1955.

On the basis of other measurements at Sierra Ancha watersheds flood potentials and sediment are factors that must be considered along with water yield. Generally the high water-yielding areas are low sediment-producing areas unless they are abused, because storm intensities are not great and there is sufficient precipitation to maintain an effective vegetation cover to control erosion. On the other hand the low water-yielding areas are generally high sediment-yielding areas because of the high intensity summer storms and the severe climatic conditions which create a delicate balance between the vegetation cover and erosion. Once this balance is disturbed or broken by drought or abuse or both it is difficult to reestablish a protective cover of vegetation sufficient to control erosion and sediment movement during high intensity storms.

Hall, T. F., and Smith, G. E. EFFECT OF FLOODING ON WOOD PLANTS, WEST SANDY DEWATERING PROJECT, KENTUCKY RESERVOIR. Jour. Forestry 53: 281-285. 1955.

The West Sandy Dewatering Project has operated more or less as an uncleared or partially cleared flood-control reservoir with fixed maximum discharge. Flooding has had an adverse effect on bottomland forests, and much of the timber in the storage basin has been killed. The tolerance of 39 woody species to periodic flooding was determined. All woody species were killed where the root crowns were periodically flooded more than 54 percent of the time during all the growing seasons the project had been operated. However, these species subjected to less flooding at higher elevations showed varying degrees of tolerance with survival contours stratified over some 12 feet vertically.

Juhren, G., Pole, R., and O'Keefe, J. CONVERSION OF BRUSH TO GRASS ON A BURNED CHAPARRAL AREA. Jour. Forestry 53: 348-351. 1955.

A thick cover of Italian ryegrass was established on an area in the foothills of the San Gabriel Mountains previously denuded by fire. This grass species forms a satisfactory cover from the standpoint of erosion control and the relative ease of controlling fire. Reestablishment of the original chaparral cover was prevented by three spray applications of a mixture of 2, 4-D and 2, 4, 5-T. At the time of preparation of this report, the cover had been self-maintaining for 4 years, having increased in density in favorable years, and decreased somewhat in a winter of little rain and high temperatures. Small experimental plots of various grasses showed favorable results for mountain brome and Wimmera ryegrass and less favorable results from orchard grass and red fescue.

Lemmon, P. E. FACTORS AFFECTING PRODUCTIVITY OF SOME SOILS IN THE WILLIAMETTE BASIN OF OREGON FOR DOUGLAS FIR TIMBER. Jour. Forestry 53: 323-330. 1955.

Site quality for Douglas fir was studied in relation to land and climatic factors on 310 selected plots in the Williamette Valley. These sites represented even-aged, normally stocked, unmanaged stands.

Total effective-soil depth was the most important factor in determining the productive capacity of a site for Douglas fir timber. This factor appears to gain its importance through the internal water relationships of the profile as they influence plant growth.

Ralston, C. W., and Barnes, R. L. SOIL PROPERTIES RELATED TO THE GROWTH AND YIELD OF SLASH PINE PLANTATIONS IN FLORIDA. Soil. Sci. Soc. Amer. Proc. 19: 84-85. 1955.

This study was initiated to explore the possibility of correlating mappable soil characteristics with the growth and yield of slash pine plantations in Florida. Concomitant tree measurements and soil samples were taken in 269 planted stands of slash pine in Florida. The relation between the height and age of the dominant stand and 12 soil variables were analyzed by multiple regression methods. Functions of two soil characteristics, the depth to a zone of mottling, and the depth to a fine-textured horizon, showed a high degree of correlation with height growth. Field determinations of the soil properties cited above may be used to estimate the yield capabilities of slash pine planting sites.

Ray, H. C., and Lawson, M. SITE CHARACTERISTICS AS A GUIDE TO FOREST AND GRAZING USE IN THE OZARKS. Jour. Range Mgt. 8: 69-73. 1955.

An extensive field investigation was made to correlate soil type and conditions with site indexes of important trees. Growth rates of 4 species of trees were measured on 1,018 plots on 9 soil types, differing in depth and stoniness. A general appraisal of the site indexes or soil productivity for the 4 tree species provided a rating which could be used to determine whether a site should be in forest or used for range.

Low potential timber sites are correlated with very shallow and shallow soils, very slowly permeable and freely permeable deep soils, and rough stony land.

Combinations of soil and other site factors associated with savannah and forest areas offer a classification of site values that is usable in determining the best use of land. An understanding of the relations between soils and site index will do much toward helping technicians in the Ozarks make a practical determination of site productivity.

Rowe, P. B. EFFECTS OF THE FOREST FLOOR ON DISPOSITION OF RAINFALL IN PINE STANDS. Jour. Forestry 53: 342-348. 1955.

Results are presented of a series of litter pan, lysimeter, and moisture sampling experiments designed to measure (1) evaporation from forest floors of pine stands in California, and (2) the influences of these floors on surface runoff, percolation, and evaporation from the soil. Three studies were carried on in the west-side ponderosa pine forest of the Sierra Nevada near Bass Lake and North Fork, Calif. A fourth study of forest floors from Monterey pine stands was conducted at Berkeley, Calif.

Evaporation from the forest floor varied with the depth of floor, duration of snow cover, and number and distribution of storms. During winter, when storms were frequent and the floors continuously wet, evaporation was about equal from all depths. When the floors were covered with snow, evaporation was negligible. During the rest of the year when storms were more widely spaced, particularly during spring and summer, evaporation was more dependent upon the amount of water in storage and was greatest from the deepest floors with the highest water-storage capacities.

In lysimeters, surface runoff and evaporation were much greater and percolation correspondingly less from bare than from forest-floor-covered soils. Percolation started sooner and lasted longer each year from the covered than from the bare soils. These differences in surface runoff and percolation were much more pronounced during years of heavy than during years of moderate or light rainfall.

Wahlenberg, W. G. SIX THINNINGS IN A 56-YEAR-OLD PURE WHITE PINE PLANTATION AT BILTMORE. Jour. Forestry 53: 331-339. 1955.

An eroded site of index 67, closely planted to white pine of uncertain seed source in 1899, has been thinned from below six times since 1916, each time to a basal area of about 100 square feet. Trees cut were usually those with crowns less than 35-percent total height. By 1953, there were 124 trees per acre big enough for saw logs in the thinned stand and 100 per acre unthinned. The trees average 4 inches larger in diameter breast height in the thinned stand. Spacing is now 12 percent of height on the unthinned plot, and 24 percent of height on the thinned plot.

In 50 years 20 cords in 505 trees, or 22 percent of the yield, was lost in mortality per acre unthinned. On the thinned area mortality was arrested by harvesting 31 cords in 730 trees, or 43 percent of the yield. Mean annual increment is 1.6 cords with thinning and 1.2 cords without. Hence production at 56 years in merchantable cubic feet, including both pulp and saw logs is 35 percent greater with thinning than without.

Because trees with saw logs have a higher unit value, the full advantage from thinning is deferred until they have grown. So far, total production with thinning is 50 percent greater in board feet. The average stumpage value of each surviving tree on the unthinned plot is now $0.80; the average reserved tree on the thinned plot is worth $3.05. On a per-acre basis, the total stumpage value gained in 56 years by thinning is $198.40.

Youngberg, C. T. EFFECT OF SOILS ON THE ESTABLISHMENT OF TREE CROPS. Soil Sci. Soc. Amer. Proc. 19: 86-90. 1955.

The soil factors significant in the establishment of both planted stock and seedlings from natural or artificial seedfall are: texture and structure characteristics of the soil profile as they affect moisture and aeration, depth to the ground-water table, content of organic matter, and chemical properties including soil fertility and the occurrence of layers high in soluble salts and toxic substances.

Crecink, J. C., and Burdick, R. T. FARM RENTAL ARRANGEMENTS, NORTHEASTERN COLORADO IRRIGATED AREA. Colo. Agr. Expt. Sta. Bul. 424-A. 1953.

This report is based primarily upon detailed records obtained in the spring of 1951 from 201 tenant farmers selected at random in 7 counties of northeastern Colorado. The study was intended to describe rental arrangements in the irrigated area of this part of the State.

Most of the 201 tenants rent on a share-basis. A current problem that confronts both landlords and tenants on these farms arises from the fact that much of the alfalfa crop is now sold to alfalfa dehydrators, which reduces the number of livestock on farms, increases the cost of alfalfa hay in the area, and forces adjustments in leasing arrangements. An additional problem arises because of the rapid introduction of irrigated pastures to help maintain soil fertility and increase livestock numbers. Arrangements need to be worked out to permit irrigated pasture to take the same place on rented as on owned land.

Cross, A. J., and Willis, J. E. ORGANIZATION AND OPERATION OF FARMS IN THE CLAYPAN AREA OF SOUTHERN ILLINOIS, WITH SPECIAL REFERENCE TO WAYNE COUNTY. Ill. Agr. Expt. Sta. Bul. 579. 1954.

Land tenure is of particular significance in the claypan area of Illinois, especially in Wayne County. When the area was surveyed in 1948, the situation was characterized by the relatively young age at which farmers acquired ownership of land, even though it may have been only a small acreage. Farmers tended to expand their farm operations by renting, occasionally buying, additional land. Generally, they retired on the land. Because of the nature of the soils, farms in this area are small, capital inputs, land values, volume of production, and income per farm are low. Much part-time farming is carried on.

However, in 1948, rapid changes in technology were taking place on many farms. As a result, production and income possibilities far exceed those thought possible only a few years earlier. Desirable improvements would involve using more capital in the farming business for building up the soil, increasing livestock numbers, and providing necessary buildings and equipment. Results being obtained on experiment fields and demonstrated on some farms in the area indicate that such capital investments are sound for the farmer who has average or better managerial ability.

Garlock, F. L., Wallace, M. E., Bierman, R. W., and Love, H. M. FINANCIAL STRUCTURE OF VIRGINIA AGRICULTURE. U. S. Dept. Agr. Agr. Inform. Bul. 97. 1953.

The chief weakness in the financial structure of Virginia agriculture is the large number of commercial farmers who operate on a scale too small to produce an adequate income. More than a fifth of the commercial farms involved investments of less than $5,000, and a third involved investments of only $5,000 to $9,999. Average investment was lowest--about $9,000--for tobacco farms. Livestock farms, with $26,000, had the largest average investment. Most of the small-scale farmers have little in the nature of liquid financial reserves, which is true also of some medium and large-scale operators. The problems of small-scale operators arise from many sources but those emphasized in this report are low income, small net worth, little use of credit, and an apparent aversion to operating as tenants. This circle of relationships might be broken in several ways: adopt improved farming systems; use more borrowed capital, along with assistance in planning operations; and change the conditions of tenancy to make tenant operation more attractive to farmers with limited capital. The study indicated that many small-scale operators could increase their incomes substantially by investing their limited capital more largely in livestock and machinery and operating as tenants of larger farms, instead of buying small farms.

Gregory, W. F. ECONOMICS OF PASTURES IN FEEDING SYSTEMS FOR DAIRY COWS. Ala. Agr. Expt. Sta. and U. S. Dept. Agr., Agr. Res. Serv., Prod. Econ. Res. Br. Bul. 296. 1955.

Farmer interest in and the need for information relative to the profitableness of different grazing and feeding systems led to this economic study of several important grazing crops and their use in milk production in the Piedmont Area of Alabama.

Forages included were (1) white clover-Dallisgrass, (2) white clover-carpetgrass, (3) Ladino-fescue, (4) sericea, (5) annually seeded crimson clover-ryegrass, and (6) reseeding crimson clover-Bermudagrass.

Costs of producing forages with recommended practices were estimated for five of these forages. The estimated per-acre costs for sericea were $20.60, and those for annually seeded crimson clover-ryegrass were $50.04. Costs for other crops (except white clover-carpetgrass) ranged from $25.17 to $28.40.

Estimated annual yields per acre varied from about 5,400 pounds of dry matter from white clover-carpetgrass to about 10,400 pounds of white clover-Dallisgrass. None of the forages studied produced growth in all months of the year, and in the coldest months growth of all forages was scant.

Hoglund, C. R., and Cook, R. L. RECOMMENDED FERTILIZER AND PRODUCTION PRACTICES REDUCE UNIT COSTS AND INCREASE NET RETURNS. Mich. Agr. Expt. Sta. Quart. Bul. 37: 150-165. 1954.

The cost and returns of producing an acre of wheat, oats, corn, alfalfa-brome, and sugar beets were calculated for the different combinations of practices and fertilizer use. Chief considerations were the relative costs and returns for different rates of fertilizer application and different levels of production practices. The costs included fertilizer, manure, seed, a land charge, and all planting, growing, and harvesting costs. Pre-harvest costs for recommended practices included extra costs for better drainage, improved machinery, legume seeds, and other rotation expenses. An allowance was made for the cost of applying the extra fertilizer. Tractor, machinery, fuel and oil, labor, and other operating costs were based on average field operations performed, multiplied by physical inputs and costs for each operation. Harvesting and hauling costs were those charged by custom operators during 1953. A land charge ranged from $7 to $10 per acre, depending on the location of production within the State for each crop grown. The results are shown in the following table:

Increased crop yields resulting from adoption of recommended production practices and use of recommended quantities of fertilizer

Crop	Unit	Increase in yield per acre resulting from:		
		Change from current to recommended production practices	Change from current to recommended fertilizer application	Change from current to recommended prod. pract. and fert. appl.
Wheat	bu	5.0	15.0	21.0
Oats	bu	14.0	8.0	24.0
Corn	bu	9.0	13.0	23.0
Alfalfa-brome hay	ton	.7	.6	1.4
Sugar beets	ton	3.5	2.5	6.5

Jensen, H. R., Heady, E. O., and Baumann, R. V. COSTS, RETURNS AND CAPITAL REQUIREMENTS FOR SOIL-CONSERVING FARMING ON RENTED FARMS IN WESTERN IOWA. Iowa Agr. Expt. Sta. Res. Bul. 423. 1955.

The estimates of this study are based on alternative complete budgets for each of 40 farms. These budgets estimate the physical production, capital requirements, costs, and gross and net incomes for each farm in the sample under five different farming systems (one soil-exploitive and four soil-conserving, one of which is cash-crop and the other three include different livestock programs). The 40 farms were a subsample representative from a large sample of 140 farms. The analysis shows: (a) The tenant's net income is increased by adjusting to soil conservation farming, irrespective of the leasing system, (b) the tenant's net income from a soil-conserving farming system including a dairy-hog program was larger under a crop-share-cash lease than under a livestock-share lease, (c) the landlord's net income was increased by adjusting to soil-conserving farming systems under a livestock-share lease but not under a crop-share-cash lease. In other words, a landlord may realize less from a soil-conserving farming system if a crop-share lease is retained on the farm. The leasing system affected the average net income of the landlord.

Kristjanson, K. TVA LAND ACQUISITION EXPERIENCE APPLIED TO DAMS IN THE MISSOURI BASIN. S. Dak. Agr. Expt. Sta. Bul. 432. 1953.

This bulletin analyzes the concepts and procedures used in acquiring private land under the right of eminent domain; analyzes and compares TVA land acquisition, land management, and relocation procedures with those used by Federal agencies in the Missouri Basin; and determines the extent to which methods used by TVA may help in resolving problems found in the Missouri Basin. Sixty-three farmers, displaced by the Kentucky, Cherokee, and Fort Loudoun reservoirs, were interviewed. Twenty-six businessmen and other leaders were interviewed also. The Kentucky reservoir is in an area that is somewhat similar to the Wappapello Reservoir, Mo., which was studied earlier, and the two land acquisition programs were carried on betwen 1938 and 1943. Thus, the effectiveness of different procedures used by TVA and the Army Engineers could be compared.

The study showed that those displaced by TVA reservoirs are usually satisfied with the procedures used in determining just compensation. The TVA land-acquisition program has been successful because "fair market value" was interpreted to mean the price required to leave the landowner in the same financial position after the taking as he was before; a detailed mapping system made possible a more accurate appraisal; a background study of the reservoir area provided a firm base for judging land values; the landowner was invited to accompany the appraiser when the first appraisal was made; payment for the farm was made promptly, usually from 2 to 3 years before the land was needed; and the Extension Service, working with the TVA, helped people get established in their new locations.

Mullins, T. ECONOMIC APPRAISAL OF FARMING PRACTICES AND ROTATION PROGRAMS ON LOUISIANA RICE FARMS. La. Agr. Expt. Sta. and U. S. Dept. Agr. Agr. Res. Serv., Prod. Econ. Res. Br. Bul. 491. 1954.

Rice farming in Louisiana has changed rapidly in recent years. Use of combines for harvesting has reduced the direct labor for this operation to less than 2 man-hours per acre, or one-eighth of all labor used in the production and harvesting of rice. A sample of 208 rice farmers in the 9 major rice-producing parishes of the State were interviewed. A rotation of 2 years in rice and 3 years in temporary pasture gave an average yield for rice of 16 barrels per acre compared with 12 barrels when the land is in rice and native grass pasture in alternate years. With 1949 cost-price relationships, the estimated net returns to labor, management, and land for a 400-acre rice farm, with half the cropland in rice each year and half in native grass or a combination of native grass and lespedeza pasture, were between $5,500 and $6,000. With rice grown for 2 years and annual pasture crops for 3, estimated returns were about $7,000. Establishment of well-improved pastures on the land held out of rice for 3 years gave estimated net returns of about $11,600. For the rotation programs that included the 3 and 4 years of improved pasture, about a third of the gross receipts were derived from beef cattle.

Sauer, E. L., and Case, H. C. M. SOIL CONSERVATION PAYS OFF. RESULTS OF TEN YEARS OF CONSERVATION FARMING IN ILLINOIS. Ill. Agr. Expt. Sta. Bul. 575. 1954.

Studies were started in three areas of Illinois from 1936 to 1940: In McLean County in 1936; in Madison and St. Clair Counties in 1939; and Stephenson, Jo Daviess, and Winnebago Counties in 1940. These were designed to measure the effect of soil and water conservation on crop and livestock production and on farm incomes for a period of years.

It was found that better earnings resulted from better soil-conservation and fertility-improvement practices on Illinois farms.

In the 10 years studied, the net earnings of a group of high-conservation farms in McLean County averaged $4.77 per acre per year higher than those of a comparable group of low-conservation farms (at 1945 prices). The differences varied among counties. The earning value of the land increased on the high-conservation farms. These increases also varied among counties. Some of the benefits of soil conservation show up the first year. Others are not apparent until the rotation has gone through a complete cycle and a crop of deep-rooted legumes has been plowed down. The overall conclusion is that money spent on conservation is a sound investment.

Sitler, H. G., Connell, W. E., Burdick, R. T., and Wheeler, S. S. ALFALFA HARVESTING AND FEEDING: RELATIVE EFFICIENCY OF HARVESTING ALFALFA BY VARIOUS METHODS AS SHOWN BY HARVESTING COSTS AND GAINS OF FATTENING STEERS. Colo. Agr. Expt. Sta. Bul. 417-A. 1954.

This study reports the findings of a farm survey on costs to harvest and feed alfalfa and 3 years of feeding experiments at Colorado A and M College on gains obtainable from alfalfa harvested and fed in different forms. Methods of harvesting include stacking with buckrakes or sweep stackers, windrow chopping, windrow baling, and ensiling.

It was found that although they require more expensive equipment, ensiling, baling, and chopping replaced labor and resulted in increased yields and quality, as compared with stacking. Costs of harvesting and feeding one cutting from an acre of alfalfa were smallest for chopped alfalfa and highest for ensiled alfalfa--chopped $6.71, baled $8.59, stacked $10,83, and ensiled $23.06.

In fattening beef steers, windrow-chopped alfalfa gave the highest net return, and ensiled alfalfa the lowest.

Slusher, M. W. THE USE OF AIRPLANES ON RICE FARMS IN ARKANSAS. Ark. Agr. Expt. Sta. Bul. 541. 1953.

Use of airplanes for some production operations on rice farms is a recent major development in mechanization. This study was designed to ascertain the extent and economic feasibility of their use. Data were collected from 25 commercial agricultural flying services and 76 farmers in Arkansas. Work done by the 25 services accounted for approximately 95 percent of the work done by planes on Arkansas ricefields. This work included, planting, fertilizing, poisoning weeds with 2,4-D, and field dessication. Operations were also performed on other crops on these farms. Seeding by plane offers opportunity to increase yields. The farmers interviewed estimated that yields averaged about a 27-percent increase, or 16 bushels per acre, because of seeding by plane. They also thought planes the only practical way to apply nitrogen fertilizer as a topdressing to the rice and to apply 2,4-D for weed control. Results from application of desiccants by plane were questionable in 1952, and more experimental work is needed before the effectiveness of this practice can be appraised. Adoption of hourly rates set to allow the flying service a fair return, and speeding up performance through improved distributing equipment and efficient operation to lower per-acre costs to farmers would increase the effectiveness and capacity of the work done at rates reasonable and fair to all concerned.

Slusher, M. W. ENTERPRISE COSTS AND RETURNS ON RICE FARMS. Ark. Agr. Expt. Sta. and U. S. Dept. Agr. Agr. Res. Serv. Bul. 549. 1955.

Crops grown on rice farms, in order of frequency reported in 1947, were rice, oats, lespedeza, soybeans, corn, and cotton. Provision was made for handling the maximum acreage of rice. Other crops, or crops and beef cattle, were then added to fill out the farm organization and utilize the facilities not required for rice.

Rice farming requires a relatively heavy investment in machinery and equipment, even on small farms. At 1954 prices the necessary equipment on a farm with 120 or less acres of rice and with no row or hay crops required an investment of $22,800 allowing for combine harvesting. This included a $5,000 charge for pumping plant.

Labor, power, and equipment were the major requirements for crop production. The same general items of power and equipment were used on the major crops. Principal exceptions were: Row crops required a general-purpose tractor, planter, and cultivator; hay crops required a mower, rake, and baler in addition to the equipment kept for rice production.

Strand, E. G. FARMING ALTERNATIVES FOR POTATO GROWERS ON THE EASTERN SHORE (VIRGINIA-MARYLAND). U. S. Dept. Agr. Agr. Inform. Bul. 102. 1953.

Early commercial potatoes from the Eastern Shore of Virginia have met strong competition during the last 20 years. Production of early potatoes declined by about half in this area but in the country as a whole, production approximately doubled. From 1929 to 1949 the number of potato growers on the Eastern Shore decreased by 70 percent, the acreage of potatoes was reduced by 60 percent, and production of potatoes declined by about 50 percent. Yields have risen less rapidly here than in most competing areas, chief of which are in California, New Jersey, and North Carolina. High quality of potatoes marketed and lower costs of production per bushel would strengthen the position of the Eastern Shore in competition with other early potato-growing areas. Improved plans for 4 of the 90 farms studied show how farm incomes could be increased by using cropping systems that will build fertility and increase yields, by growing more crops, which will spread risk and also employment throughout more of the year, by increasing production of hogs and poultry, and by increasing production of food for use in the household.

Thair, P. J. MEETING THE IMPACT OF CROP-YIELD RISKS IN GREAT PLAINS FARMING. N. Dak. Agr. Expt. Sta. and U. S. Dept. Agr., Agr. Res. Serv., Prod. Econ. Res. Branch Bul. 392. 1954.

Results of the all-risk crop insurance study indicate several conclusions. First, on the average, within an area such as a county, there is a modest tendency for the more vulnerable farmers to subscribe to crop insurance in greater numbers than more fortunate ones. But between areas of greater and lesser yield variability, perhaps the basic vulnerability factor, there is no evidence to show that the high-risk area farmers participate in greater numbers than those in the area of lower risk. Instead, the critical factor seems to be the premium rates charged.

Where the risk is greater the need is greater, but the premiums are also larger and the single-crop premiums now are at a level that loom large relative to farmers' budgets. As risk or vulnerability increases, so does the tendency to attempt to protect oneself; but as insurance premium rates increase, so does the tendency to resort to other types of security practices.

VARY, K. A. ECONOMICS OF GRASSLAND FARMING. Mich. Agr. Expt. Sta. Spec. Bul. 391. 1954.

This publication deals with the changes in farm organization, investment, costs, and returns resulting from a change in the grass program on an individual farm.

Changes may be brought about by shifting the proportion of the land in hay and pasture or by merely adopting different cultural practices. Evidence of the latter is provided by the large number of Michigan farmers who have kept about the same acreage in grass but have increased their earnings by increasing crop yields.

A farmer, thinking of shifting his present acreage of hay and pasture, should consider the possible effects this change may have on his farm organization and earnings.

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